



# **Eumach VMC-1100**

## **VERTICAL CNC MACHINING CENTER**

### **INSTALLATION & MAINTENANCE MANUAL**

This manual contains the original manual's text and figures unchanged.  
For the purpose of better understanding and corresponding to the manual in Hungarian,  
the NCT Ipari Elektronikai Kft. has only changed the format e. g. numbering of contents;  
and converted the original units of measure into SI ones.

## CONTENTS

1. OPERATIONAL SAFETY AND CAUTIONS .....	5
1.1. Operational Safety Rules.....	5
1.1.1. Definition of Warning Label .....	6
1.1.2. Warning Label Attaching Positions .....	7
1.1.3. Instructions of Warning Labels .....	9
1.2. Safety Rules.....	11
1.2.1. Operational Safety and Notices.....	11
1.2.2. General Safety Rules .....	11
1.2.3. Operational Safety Rules.....	11
1.2.4. Cautions Before Operation.....	12
1.2.5. Standard Procedures For Turning Power Off.....	12
1.2.6. Cautions for Control and Electric Equipment .....	12
1.3. Safety Device .....	13
2. CONSTRUCTION OF MACHINE .....	15
2.1. Description of Mechanisms.....	18
2.2. Axis Definition on Coordinate .....	20
2.3. Spindle Specifications and Descriptions .....	21
2.3.1. Standard Spindle .....	21
2.3.2. Built-in Type High-Speed Spindle .....	21
2.3.3. Spindle Temperature Raising .....	23
2.4. Construction of Machine Magazine .....	24
2.5. Table Sizes and Loading .....	25
2.6. Air Circuit Diagram (With Linear Scale/With Labyrinth Air Blast) .....	26
2.7. Air Circuit Diagram (Without Linear Scale/With Labyrinth Air Blast .....	27
2.8. Air Circuit Diagram (Without Linear Scale/Without Labyrinth Air Blast) .....	28
2.9. Air Circuit Diagram (With Linear Scale/Without Labyrinth Air Blast) .....	29
2.10. Central Cooling Circuit diagram .....	30
2.11. Cutting Coolant Circuit Diagram .....	31
2.12. Spindle Oil Cooling Circuit Diagram (Without ZF Gearbox) .....	32
2.13. Spindle Oil Cooling Circuit Diagram (With ZF Gearbox) .....	33

2.14.	X,Y,Z-Axis Lubrication Circuit Diagram .....	34
3.	MOVING MACHINE .....	35
3.1.	Unpacking and lifting .....	35
3.1.1.	Unpacking the machine .....	35
3.1.2.	Lifting the machine .....	35
3.2.	Placing the Machine .....	37
3.3.	Removing Fixing Blocks.....	38
3.3.1.	Fixing Blocks for Machine Mechanisms .....	38
3.4.	Peripheral Mechanisms Fixing Blocks.....	39
4.	INSTALLING MACHINE .....	40
4.1.	General Requirements of Installation.....	40
4.2.	Foundation Plan.....	41
4.3.	Dimensional Drawing of Foundation Hole .....	42
4.4.	Installing Drawing of Anchor Bolt.....	43
4.5.	Dimensional Drawings Of Machine (option).....	44
4.6.	Installing Machine on Foundation.....	46
4.6.1.	Parts Dismantled Before Shipment .....	46
4.6.2.	Installing Machine Parts.....	47
4.6.3.	Power Source Required.....	48
4.6.4.	Air Source Required.....	48
4.7.	Leveling Adjustment .....	48
5.	INSPECTION ITEMS & PROCEDURES FOR POWER ON .....	50
5.1.	Inspection Items & Procedures for First Time Power On.....	50
5.2.	Power-On Inspection.....	51
6.	MAINTENANCE.....	53
6.1.	Periodic Maintenance .....	53
6.1.1.	Daily Maintenance .....	53
6.1.2.	Weekly Maintenance.....	53
6.1.3.	Half-Yearly Maintenance .....	54
6.1.4.	Yearly Maintenance .....	54
6.1.5.	Responsible Personnel for Maintenance Job.....	54
6.2.	Key maintenance items .....	55

6.2.1.	Clean Filter Screen .....	55
6.2.2.	Cleaning and Replacing the Filter Can of Coolant through Spindle Device ...	56
7.	LUBRICATION AND SUGGESTED OIL .....	62
7.1.	Fill Lubrication Oil, Cooling Oil And Hydraulic Oil.....	62
7.2.	Suggested Oil and Filling Frequency .....	63
7.3.	Suggested Oil and Amount .....	63
8.	AUTOMATIC TOOL CHANGER.....	65
8.1.	Tool Shank and Pull Stud.....	65
8.2.	Maximum Tool Sizes .....	69
8.3.	Automatic Tool Change .....	69
8.4.	How To Correctly Fit Tool.....	70
9.	ESCAPING PROCEDURES WHEN PERSONNEL CORNERED IN THE MACHINE	71
9.1.	Safety Door with Interlock Device.....	71
9.2.	Safety Door without Interlock Device .....	71
9.3.	Front Door Has Interlock Function, but Side Doors Do Not Have.....	71
10.	MACHINE TROUBLES AND CAUSES.....	73
10.1.	Brief Instructions of Troubles .....	73
10.2.	Simple Trouble Shooting .....	75
11.	CAUSES AND ANALYSIS FOR DANGER OCCURENCE .....	76
11.1.	Machine Noise.....	76
11.2.	HIGH TEMPERATURE.....	77
11.3.	Impact.....	78
11.4.	Sharp Corner .....	79
11.5.	Slipping .....	79
12.	HOW TO AVOID IMPROPER MAINTENANCE OF THE MACHINE .....	80

## **1. OPERATIONAL SAFETY AND CAUTIONS**

### **1.1. Operational Safety Rules**

1. To protect operator's safety and prevent the machine from danger or accident, we provide various safety rules for operator to follow.
2. Before operating the machine, the operator must take care of his clothing (such as boots, hamlets, safety glasses etc.)
3. Do not use any non-approved oil or lubrication oil for the machine to replace that specified in the service manual or on the label.
4. Before operating the machine, make sure workpiece has been fastened securely on the table.
5. Before operating the machine, close all safety doors.
6. Do not use bare hands to directly touch any sharp objects such as tool and chips etc.
7. During the machine is operating or running, do not approach the running area. Also do not use your hands to remove chips or workpiece.
8. When machining finished, the machine can not stop completely. When this occurs, find correction method in the operation manual. If you can not find solution, contact your local distributor for assistance.
9. During the machine is running, do not use your hands to touch or adjust the machine. If necessary, stop the machine and turn power off before adjusting.
10. Make sure the machine has come to a complete stop before opening any safety door.
11. Do not wear gloves to touch the machine or any switch or button on the control panel.
12. Make sure the tool and tool shank are fully cleaned.
13. Always keep your machine clean.
14. Keep the machine away from high-voltage equipment.
15. Do not use any fuse that is bigger than the rated specification.
16. Turn power off before replacing fuse.
17. Only an experienced technician is allowed to make maintenance on control system.
18. Before operating the machine, always follow the instructions shown on all warning labels.

### 1.1.1. Definition of Warning Label

Following warning labels indicate the degree of danger.

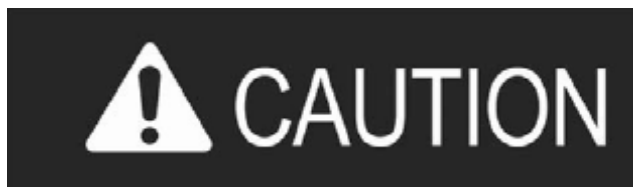
The operator must thoroughly understand the meaning of all warning labels to ensure operational safety.



It indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.



It indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

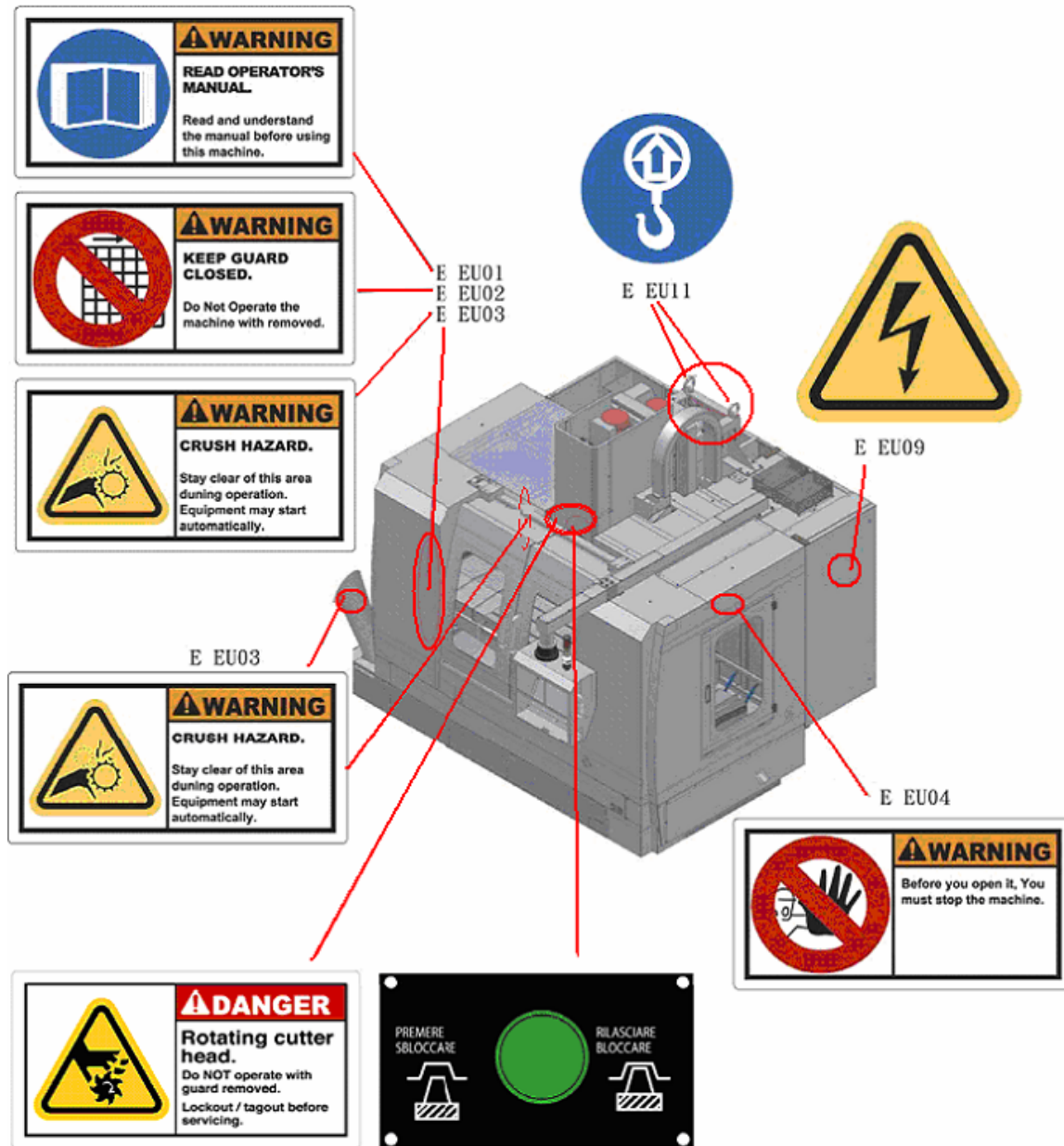


It indicates a hazardous which, if not avoided, could result in minor or moderate damage to the machine or serious injury.

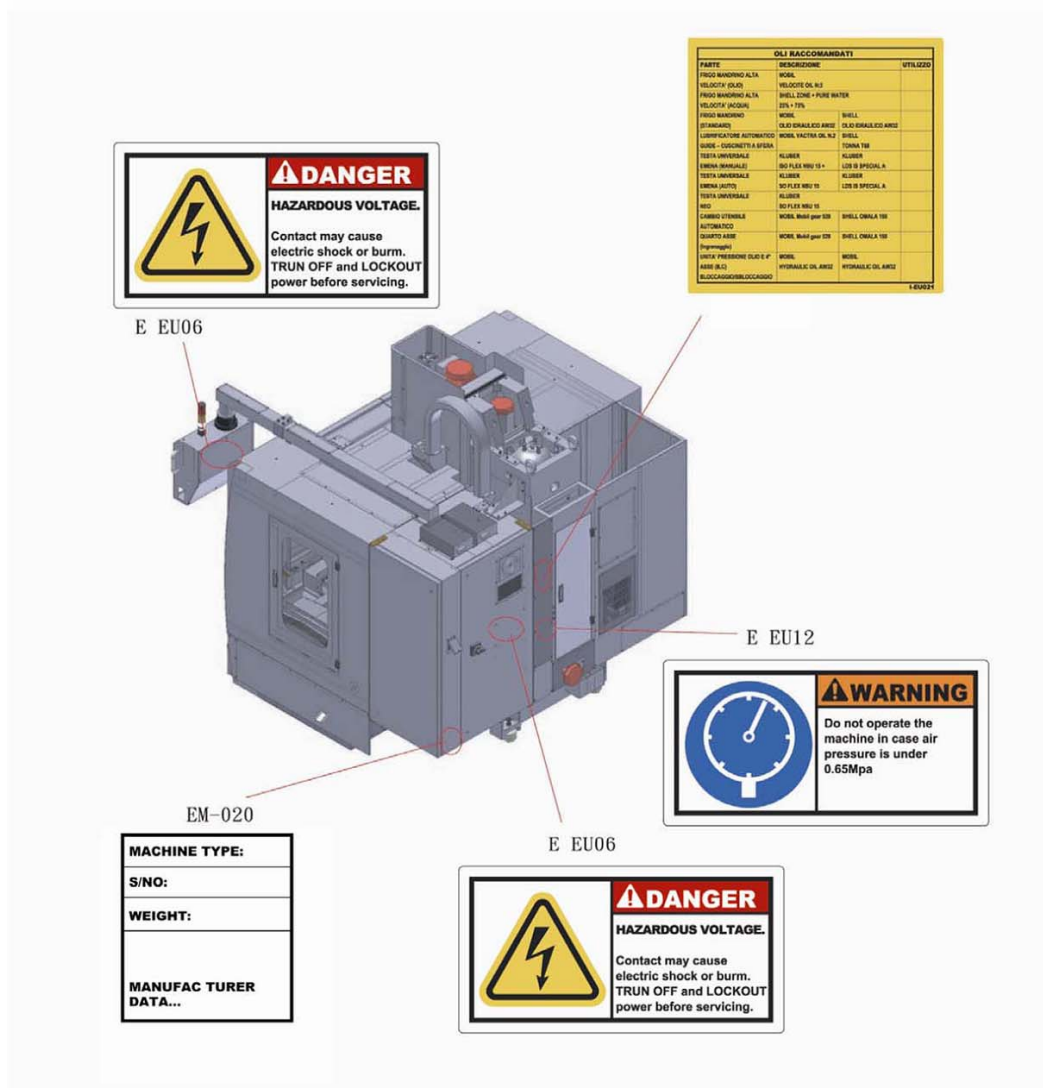


It indicates items that must be cared.

### 1.1.2. Warning Label Attaching Positions

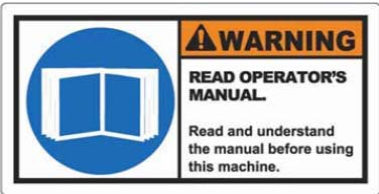











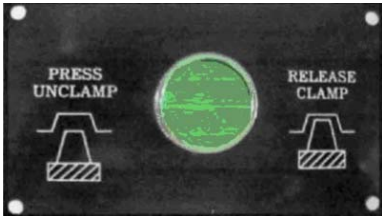






### 1.1.3. Instructions of Warning Labels

WARNING LABEL	DESCRIPTION
	<p>Before operating the machine, read and thoroughly understand the contents in the manual.</p>
	<p>When splash guard or safety door is opened, do not move or run the mechanisms to avoid the danger of splashing, crushing or cutting-off.</p>
	<p>The equipment may start automatically at any time. The operator must stay clear of this area to avoid the danger of entangling.</p>
	<p>During operating, do not open this door. Make sure the machine was come to a complete stop before opening it.</p>
	<p>Contact may cause electric shock. Before performing maintenance or repair turn off and lock out the machine.</p>
	<p>Before operating the machine check if the air pressure is under 0,65 MPa.</p>

WARNING LABEL	DESCRIPTION
	<p>The rotating spindle and cutter may create “cut-off” danger. Pay special attention when performing operation and maintenance. Do not touch the running spindle and cutter.</p>
	<p>Oil usage instruction and recommended oil brands. Oil with red marking are required by the machine. Oil a mount and replace frequency should be refer to instructions given in the maintenance manual.</p>
	<p>Lifting position indicating label. When lifting the machine, always follow the instructions given in the manual for lifting method and positions.</p>
	<p>Contact may cause electric shock. Before performing maintenance or repair, be sure to turn power off to avoid the danger of electric shock.</p>
	<p>Spindle tool clamping and unclamping instruction label. When loading and unloading a tool in the spindle, you need to press the green button.</p>

## **1.2. Safety Rules**

### **1.2.1. Operational Safety and Notices**

To avoid possible accident and ensure normal operation of the machine, it is very important to follow the safety rules.

### **1.2.2. General Safety Rules**

To follow the general safety rules will reduce the possibility of accident to a minimum. This means operating the machine in the best and safe environment may upgrade productivity while reducing loss.

1. Wear safety glasses.
2. Wear safety boots.
3. Wear safety helmet (Operator with longhair must wear it) and working clothe. The opening of clothe, such as sleeves must be fastened securely.
4. Do not wear gloves when operating the machine.
5. Keep clean and smooth around the machine keep workpiece storing position clean.
6. The working position and workpiece loading/unloading position must be firm enough. Also, make sure the foundation is rigid.
7. Except for the operator, keep all visitors away from the machine.
8. In case of poor health or spirit, do not operate the machine.

### **1.2.3. Operational Safety Rules**

1. Before operating the machine, the operator must thoroughly understand the contents instructed in this manual.
2. The operator or maintenance personnel must keep warning labels in mind at all times. Do not damage or remove the warning labels.
3. Do not remove any safety device or adjust their position without authorized to do so.
4. Check if there is any obstacle existed when table and spindle head are moving.
5. Unless to perform maintenance or adjustment, all doors and guards must be closed securely to avoid any abject entering into the NC control.
6. Do not move limit switch or stopper for changing axis travel distance.
7. Use appropriate tools for adjusting, setting up, repairing and maintaining the machine.
8. During operation, if there is any problem occurs, stop the machine immediately and press the emergency stop switch.
9. Do not place any tool on the table or guard.

10. Everyday when starting the machine, it is requested to perform spindle warm-up running to ensure the service life of spindle. Time for spindle warm-up running is 30 minutes. Spindle warm-up running is performed by 3 steps. Each step requires 10 minutes at 1/4 of the maximum speed, 1/2 of the maximum speed and the maximum speed.

#### **1.2.4. Cautions before Operation**

1. When the machine is operating, do not place your hands on any running or moving part of the machine, such as spindle, feed axes, ATC and table etc.
2. During operating, do not use your hands to remove chips on the cutting tool or the table. Wait until the machine has come to a complete stop, then you can remove chips.
3. Make sure the machine has come to a complete stop before adjusting direction of coolant nozzles.
4. Do not allow two or over two operators to operate the machine simultaneously.
5. During the machine is operating, do not play around the machine.
6. Before automatically executing programs, close the safety door firmly.

#### **1.2.5. Standard Procedures for Turning Power Off**

1. Turn power off.
2. Clean off all chips existed in the machine. (Incl. waste material).
3. Spray rust-preventative oil on table and spindle etc. to avoid rusting.

**Do not change the machine parameters or use non-approved replacement parts.**

#### **1.2.6. Cautions for Control and Electric Equipment**

When performing maintenance and inspection on control and electric equipment, following cautions should be cared:

1. Do not heavily bump against the NC control or any electronic parts.
2. Do not use high pressure air to blast off chips and dusts around the control, the table. Wait until the machine has come to a complete stop, then you can remove chips.
3. Use only wire size specified in the operation manual. Do not excessive length of wire. Do not use bare wires. All wires used must be well covered.
4. The NC parameters can be set only by the manufacturer's technician. Failure to comply may cause all values can not be changed.
5. Do not fit with additional receptacle or increase load on connecting wire.
6. Turn off NC control power and main power source before inspecting electric equipment. Also, lock the switch to prevent anyone from turning power on, that may result in danger.

7. Do not use a wet tool to touch the electric equipment.
8. Use only proper fuse specified by the manufacturer. Never try to use any high-capacity fuse or copper wire.
9. Do not keep the NC control door open for a too long time, because direct sunshine or flash may damage the electronic components.

### **1.3. Safety Device**

The safety device and position is as the figure shown and the using description is as following:

#### **Protection Cover**

The protection cover is use to prevent the workpiece of the tool or the chip flied out by accident to hurry the operator and isolate the person and the motion part of the machine to protect the operator or other person from the injury.

#### **Emergency Stop Switch**

This button is pressed to make stop in case of emergency. If this button is pressed, the axis feed and spindle rpm is stopped immediately.

#### **Alarm Lamp**

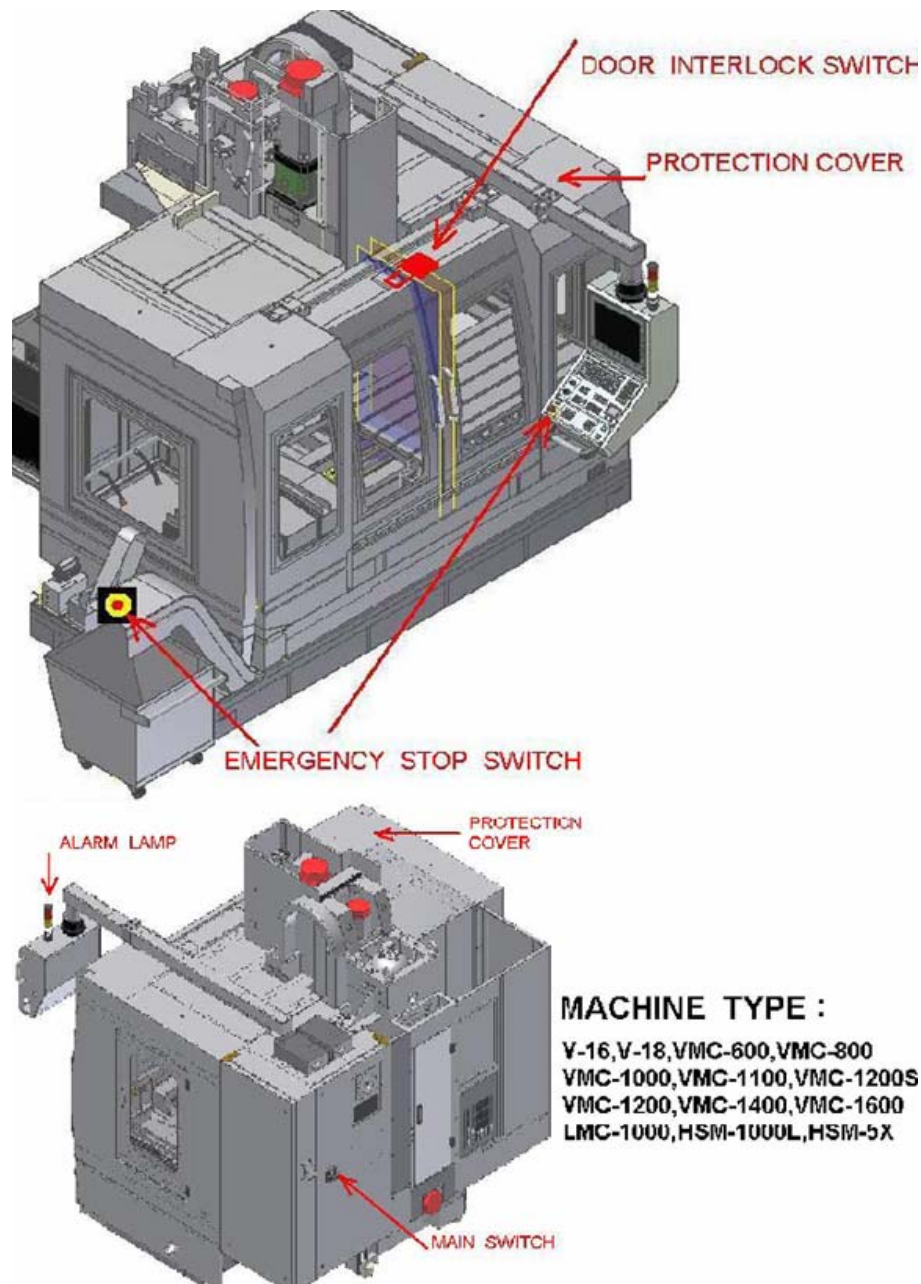
Express the control system alarm and stop operating. Take a reference on the trouble shooting.

#### **Door Interlock Switch**

Close the door of safty cover and door interlock is lock. Machine can be automatically moved by program. Only manual mode can open the safty door.

#### **Main Switch**

If the switches off, the power of the machine is closed.





## **2. CONSTRUCTION OF MACHINE**

The VMC-1100 is a vertical machining center, designed and manufactured by Eumach Co., Ltd.

This machine is suitable for precision machining for various parts and molds. In addition to equip with standard equipment, the machine is also available to equip with various optional equipment, such as 4th axis, chip auger, auto tool length measuring device, chip splash spray gun, automatic blast device, auto power off function, rear chip flushing device and coolant through spindle etc.

### **Applicable Machining Materials and Machining Types**

Cast iron, steel, aluminum alloy and bronze etc. Machining types include face milling, side milling, slot milling, drilling, tapping, boring and reaming etc.

### **Restriction of Machining**

Any workpiece shapes that can be clamped firmly. Workpiece sizes must not exceed the table sizes. Workpiece weight must not exceed the rated loading capacity of the table. Workpiece height must not be interfered with any part of the machine.

### **Machine Specifications**

Refer to the next page

### **Mechanisms of the Machine**

This machine consists of various mechanisms, including base, saddle, table, column, spindle head, spindle, magazine, splash guard, electrical cabinet, control box and coolant system etc.

The following pages describe positions and functions of these mechanisms.



### VMC-1100 Machine Specification

X,Y,Z-axis travel [mm]	1100/610/610
T-Slot sizes [mm]	18/5/1250
Max. table load [kg]	1200
Table sizes [mm]	1270x640
Table height from floor [mm]	895
Spindle speed [rpm]	8000
Spindle nose taper	BT 40
X,Y,Z-axis rapid traverse [m/min]	24(30)/24(30)/20(24)
Cutting federate [mm/min]	8000
Max, tool specifications	83 mm/8 kg/300mm
Power source capacity [kVA]	25
Machine weight [kg]	7300
Floor area occupied (L×W) [mm]	2800×2300
A.T.C	Arm type (carousel type)
Automatic lubrication pump	150 W / 14.7 bar
Coolant pump [kW]	0.8
Air pressure required [bar]	6.4

- Above mentioned specifications are standard. Special specifications and functions are not listed.
- Above mentioned floor area is only for the machine, which does not include coolant tank, chip conveyor, electrical cabinet with door opened and control box etc. Customer should leave proper space around the machine for maintenance and cleaning. When above-mentioned equipment are included, the required floor area should be as below:

VMC-1100 (L×W) 4000x3400mm

- 10,000 rpm spindle with coolant through spindle is optional.
- 15,000 rpm spindle is optional.

6	5	4	3	2	1
Nº.	Code No.	Description	Qty	Nº.	Description
11	C11730100	Backside Guard	1	1	BASE & ACCESSORY ELEMENTS
12	C11800100Y10	Y Axis Transmission Assembly	1	2	SADDLE & ACCESSORY ELEMENTS
13	C11800100X10	X Axis Transmission Assembly	1	3	Table & Accessory Elements
14	C11800100Z10	Z Axis Transmission Assembly	1	4	ELECTRICAL HARDWARE SYSTEM
15	2701H10006CTH1	Coolant Tank Assembly & Accessory	1	5	Column & Accessory Elements
16	C1130100Y00	Y AXIS LINEAR SCALE SYSTEM	1	6	Z Axis Movement Limits System
17	C11500001	Head & Accessory Elements	1	7	Z AXIS LINEAR SCALE SYSTEM
18	C11920200	OIL COOLER SYSTEM	1	8	X Axis Movement Limits System
19	1903HH100100	Chip Tank	1	9	Y Axis Movement Limits System
20	C11710200	SPLASH GUARD	1	10	X Axis Linear Scale System

Design	BIN	2008/4/15	Drawing No.	V11-001	Sheet	1 / 1
Check			Drawing Name	MACHINE MODULE ELEMENTS	Eumach 新衛電機機械	
Approval						

## **2.1. Description of Mechanisms**

### **Base**

The base supports weight of the entire machine. The foundation bolts and leveling blocks located under the base will control the leveling condition of the machine.

The column is locked on the back side of the base. The saddle and table are mounted on the base. The hardened and precision ground slideways on the base permit the saddle to move smoothly on the base.

### **Saddle**

The bottom slideways of saddle that contact the base are coated with Turcite-B, precision scraped and milled with oil grooves for increasing lubrication effect while reducing friction force. The top slideways on the saddle are hardened and precision ground, ensuring smooth movement of table.

### **Table**

The table surface is milled with T-Slots for clamping and locking workpiece. The table moves on the saddle.

### **Column**

The column is fastened on the top of base. The slideways on front of column are used for the spindle head movement. An air reservoir is equipped in the column. The spindle head is counterbalanced by bracket, air cylinder and accumulator.

### **Spindle Head**

The spindle head moves vertically on the slideways of column. Various parts are mounted on the spindle head, such as spindle motor, tool knocking cylinder and spindle etc. Its reasonable throat depth design fully meets machining travel.

### **Spindle**

The rigid spindle is driven by an extra powerful motor, making it ideal for heavy cutting. A high speed spindle is available for high speed medium or light machining for mold. The spindle is mounted in the spindle stock, which clamps tool securely through internal draw bar, disc type spring and 4-jaw. Tool clamping/unclamping motions are actuated by a tool-knocking cylinder located on top of the spindle.

### **Magazine**

The arm type tool changer permits random selection of tool for fast tool change, while reducing tool change time. The magazine is mounted on the left side of the column through a mounting interface. The magazine consists of tool change arm, cam, tool pocket, air cylinder and motor etc.

Upon request, a carousel type magazine is available.

### **Splash Guard**

The splash guard consists of splash guard, acrylic and safety door. Its function is to prevent workpiece, coolant and chips from flying out, providing safety protection for the operator and personnel around the machine.

### **Electrical Cabinet**

The electrical cabinet provides power for the entire machine. It is mounted on the right side of the column. A no-fuse breaker is provided at back side for main power source ON/OFF control. During power is turned on, heat may generate in the electrical cabinet. A heat exchanger (air conditioning device) is applied to exhaust heat.

### **Coolant Tank**

The coolant is used for storing coolant. The coolant tank capacity is over 400 liters, which is separately mounted from the machine. A chip tray is equipped on top of the coolant tank for storing chips. Upon request, a screw type automatic chip removing coolant tank or a boat-type chip removing coolant tank is available.

### **Spindle Oil Cooler**

The major function of the spindle oil cooler is to reduce the spindle temperature, that may reduce thermal deformation to a minimum. The spindle oil cooler provides two types to choose from, including oil cooling type and water cooling type. In general, the oil cooling type is suggested for a conventional spindle, while water cooling type is suggested for high speed built-in type spindle.

## 2.2. Axis Definition on Coordinate

*Axes are defined by table and spindle head moving directions:*

X-AXIS: Table moves in rightward/leftward direction.

Y-AXIS: Table moves in forward/backward direction.

Z-AXIS: Spindle head moves in upward/downward direction.

*X,Y,Z-axis movement to positive (+) and negative (-) direction are defined as below:*

+X: Table moves to left side when facing the machine.

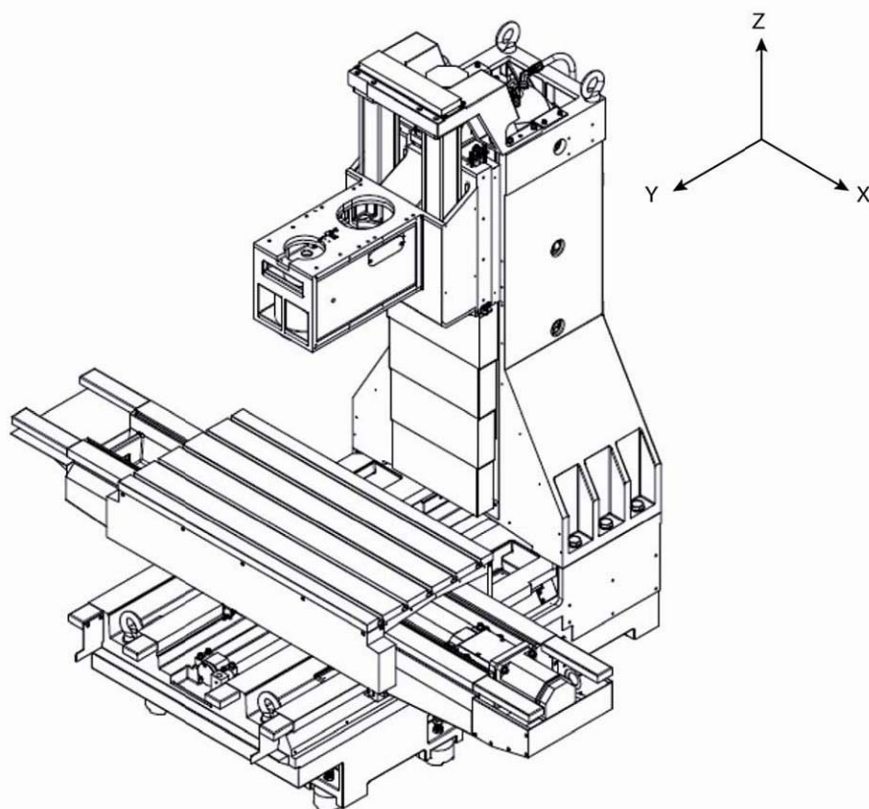
-X: Table moves to right side when facing the machine.

-Y: Table moves to column side.

+Y: Table moves to operator side.

+Z: Spindle head moves upward.

-Z: Spindle head moves downward.



## 2.3. Spindle Specifications and Descriptions

### 2.3.1. Standard Spindle

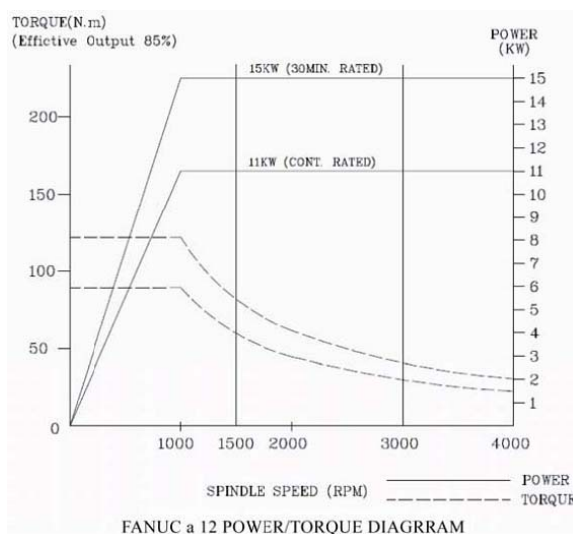
No.	ITEMS	SPECIFICATIONS	REMARKS
1	Spindle speed	8,000rpm(10,000rpm)(12,000rpm)	
2	Spindle taper	BT40(DIN69871)(CAT40)	
3	Spindle bearings	Front bearing 7010x4 Rear bearing 6510x2	
4	Spindle motor	IPH71332ND(European Series) α 12(Japanese Series)	
5	Tool clamping force	7355.0 ± 490.3 N	
6	Bearing lubrication	Grease	

### 2.3.2. Built-in Type High-Speed Spindle

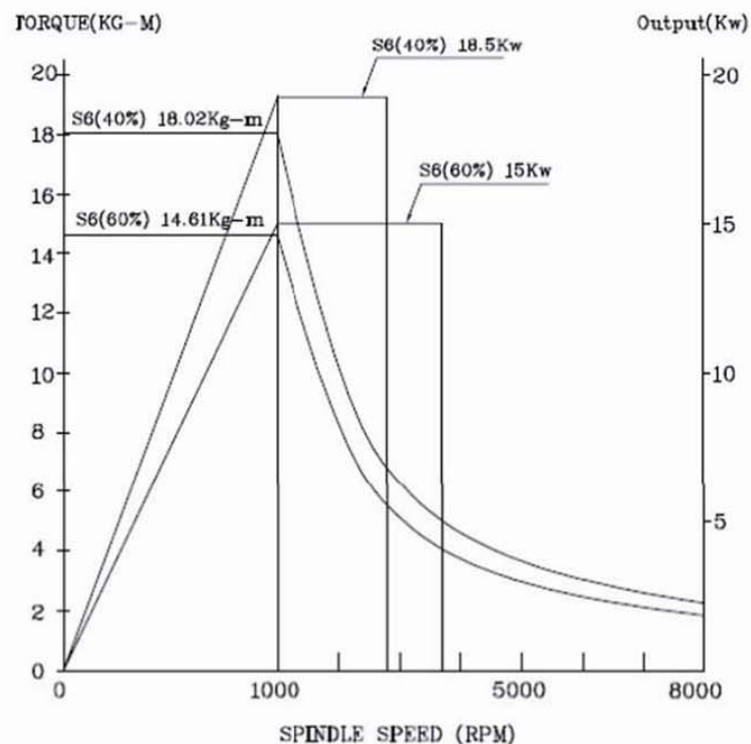
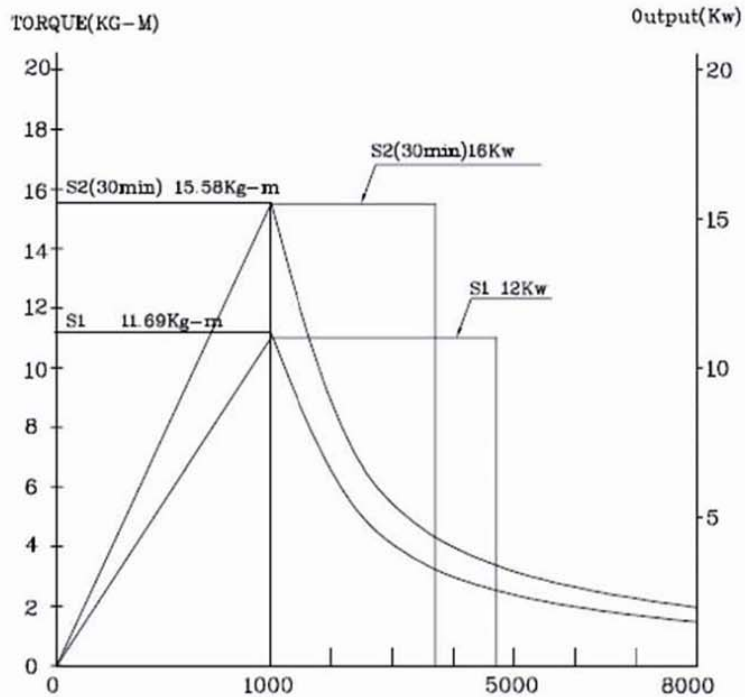
No.	ITEMS	SPECIFICATIONS	REMARKS
1	Spindle speed	15,000 rpm	
2	Spindle taper	BT40(DIN69871)(CAT40)	
3	Spindle bearings	Ceramic bearing	
4	Spindle motor	Built-in type motor	
5	Tool clamping force	7355.0 ± 490.3 N	
6	Bearing lubrication	Grease	

It is suggested to use positive pressure air tightness for bearing. Normal air pressure is 1-1.5 bar.

The spindle is a high precision part. In case abnormal noise, high temperature or poor accuracy occurs, remove the spindle assembly and send it to the NCT Ltd. for repair. Customer is not allowed to dismantle the spindle assembly.







SIMENS 1PH7133 POWER/TORQUE DIAGRAM



### **2.3.3. Spindle Temperature Raising**

1. The spindle employs oil cooling type forced cooling system, that may effectively reduce temperature raising.
2. In case the spindle temperature exceeds 20 °C (The difference between the maximum temperature on the spindle quill or the spindle stock and the room temperature), the means the spindle cooler or the spindle is abnormal. When such problem occurs, contact NCT Ltd. for repair.
3. After inspected by our service technician, if necessary, the spindle assembly should be removed and send it to our company for repair.
4. Customer is not allowed to dismantle the spindle. Failure to comply, the customer should be fully responsible for loss.

#### **Parameters Used for Cooling System**

1. Setting temperature: Room temperature:  $\pm 1^{\circ}$ .
2. Coolant: R10 or R32 oil.

#### **Tool Drawing and Unclamping**

1. The tool drawing is actuated by the pulling force created by the preloaded disc type spring. The 4 jaws on the draw bar will pull the tool shank against the spindle taper. Tool drawing motion is assisted by air pressure.
2. The tool unclamping mechanism employs an air cylinder to produce a hydraulic pushing force for ejecting the draw bar. This enables 4 jaws to open and the tool shank is released.

#### **Parameters Used for Tool Drawing and Unclamping**

1. Tool shank specif: SK40 (or SK50)
2. Pull stud specify: DIN 69872B (or BT, CAT, ISO7388)
3. Drawing force: 7845,3 $\pm$ 490,3 N (14710,0 $\pm$ 490,3 N for #50 tool shank)
4. Air pressure: 6.5 – 8.0 bar
5. Tool unclamping: By air pressure
6. Tool clamping: Clamping motion is actuated by disc spring in the spindle.

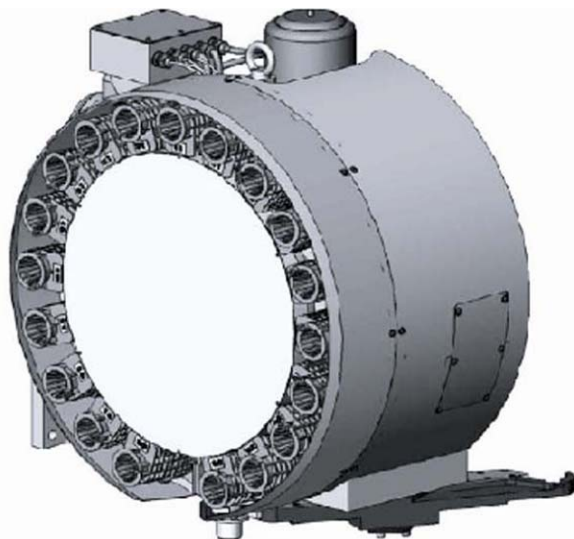
#### **Tool Balance Condition**

When spindle speed is under 6000 rpm, the tool balance should be under 6.3G.

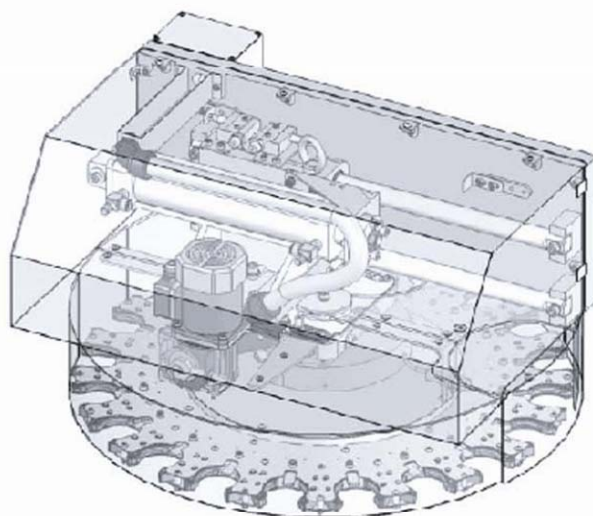
When spindle speed is over 6000 rpm, the tool balance should be under 2.5G.

## 2.4. Construction of Machine Magazine

The magazine is mounted on the left upper position of the column, which is connected to the column through a mounting interface. There are two types of magazine to choose from, including arm type and carousel type.



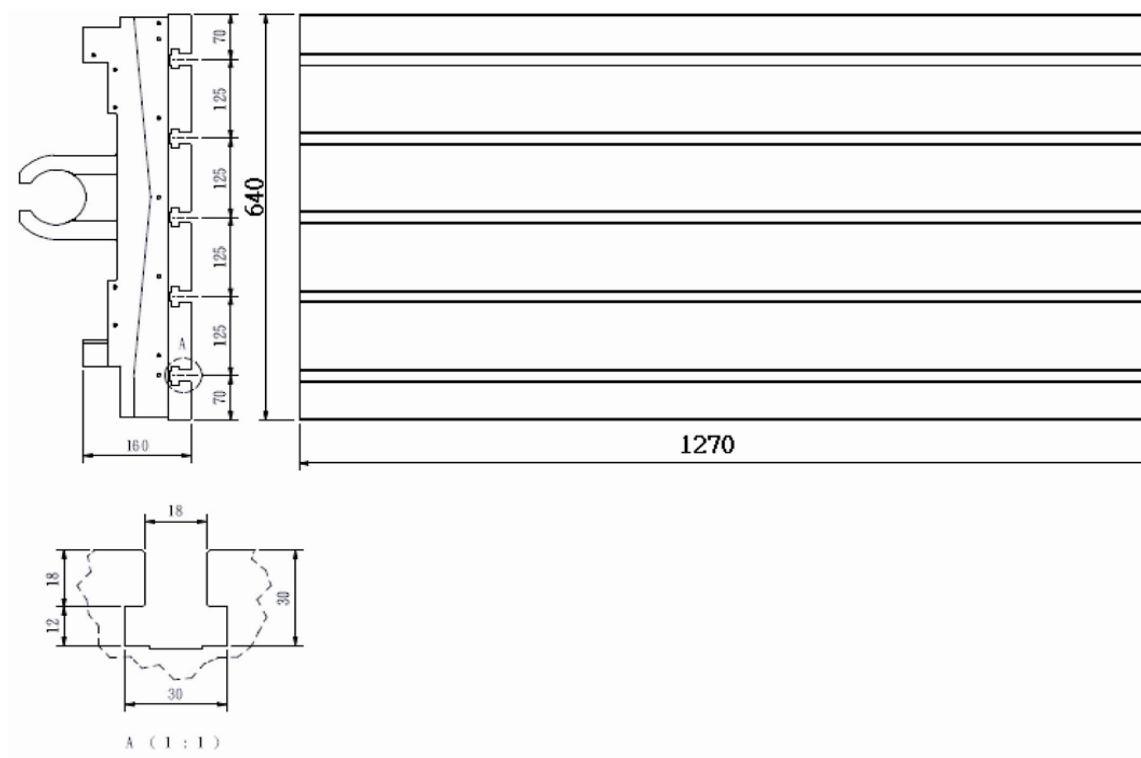
ARM TYPE MAGAZINE



CAROUSEL TYPE MAGAZINE

## 2.5. Table Sizes and Loading

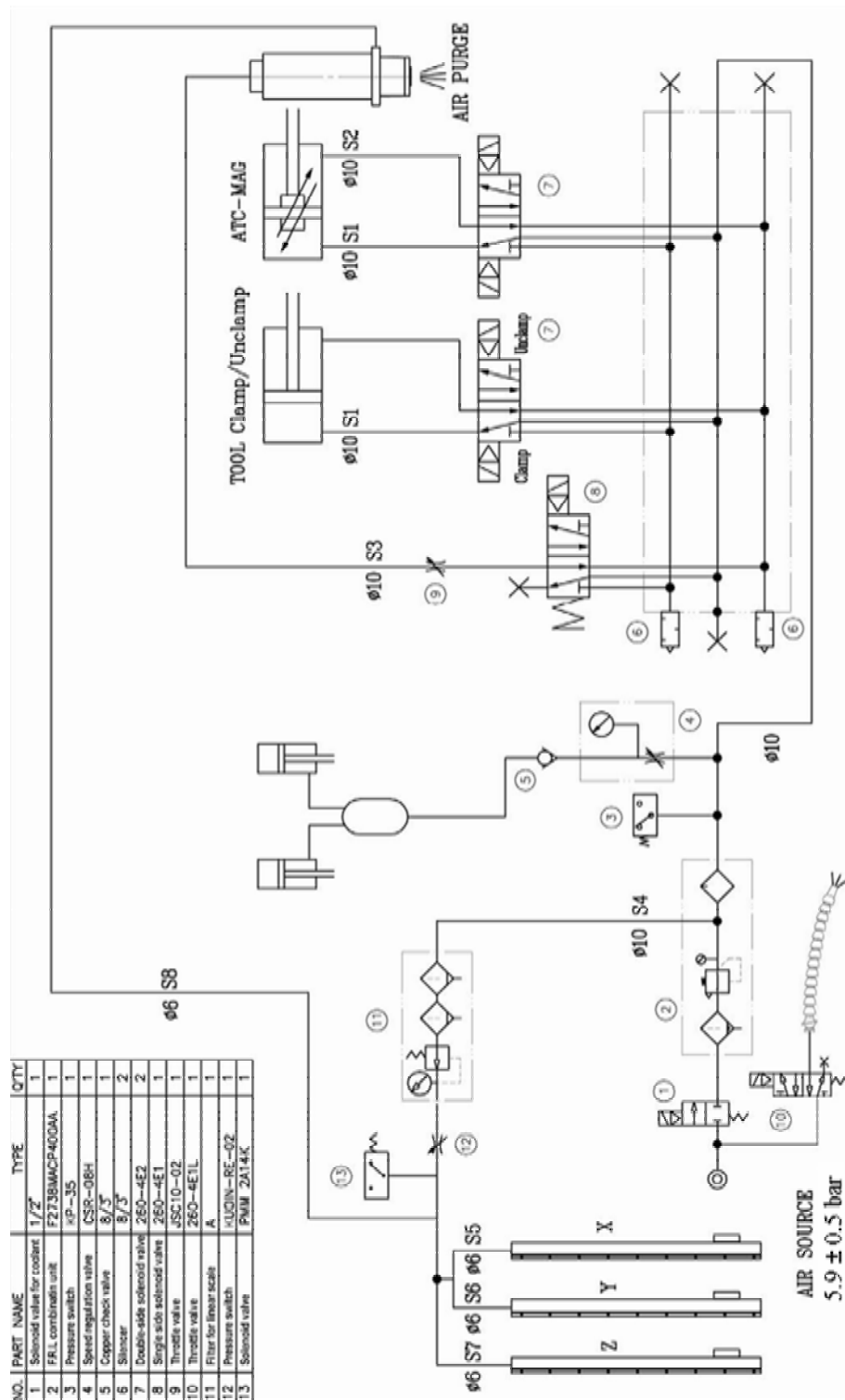
### Table Sizes



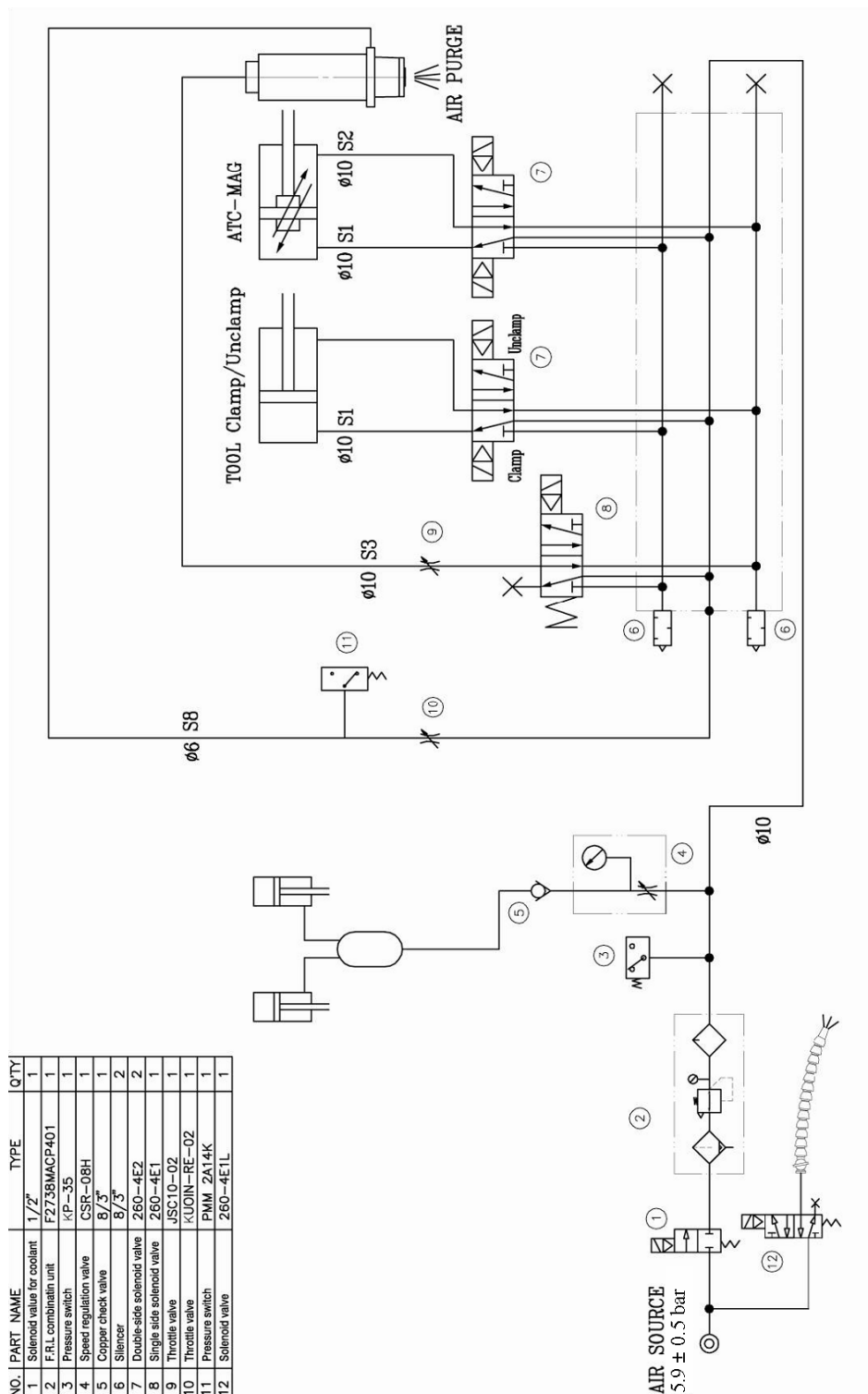
### Table Loading Capacity

DESCRIPTIONS	SPECIFICATIONS
Table sizes [mm]	1270 × 640
Max. table loading [kg]	1200
Table height from floor [mm]	900

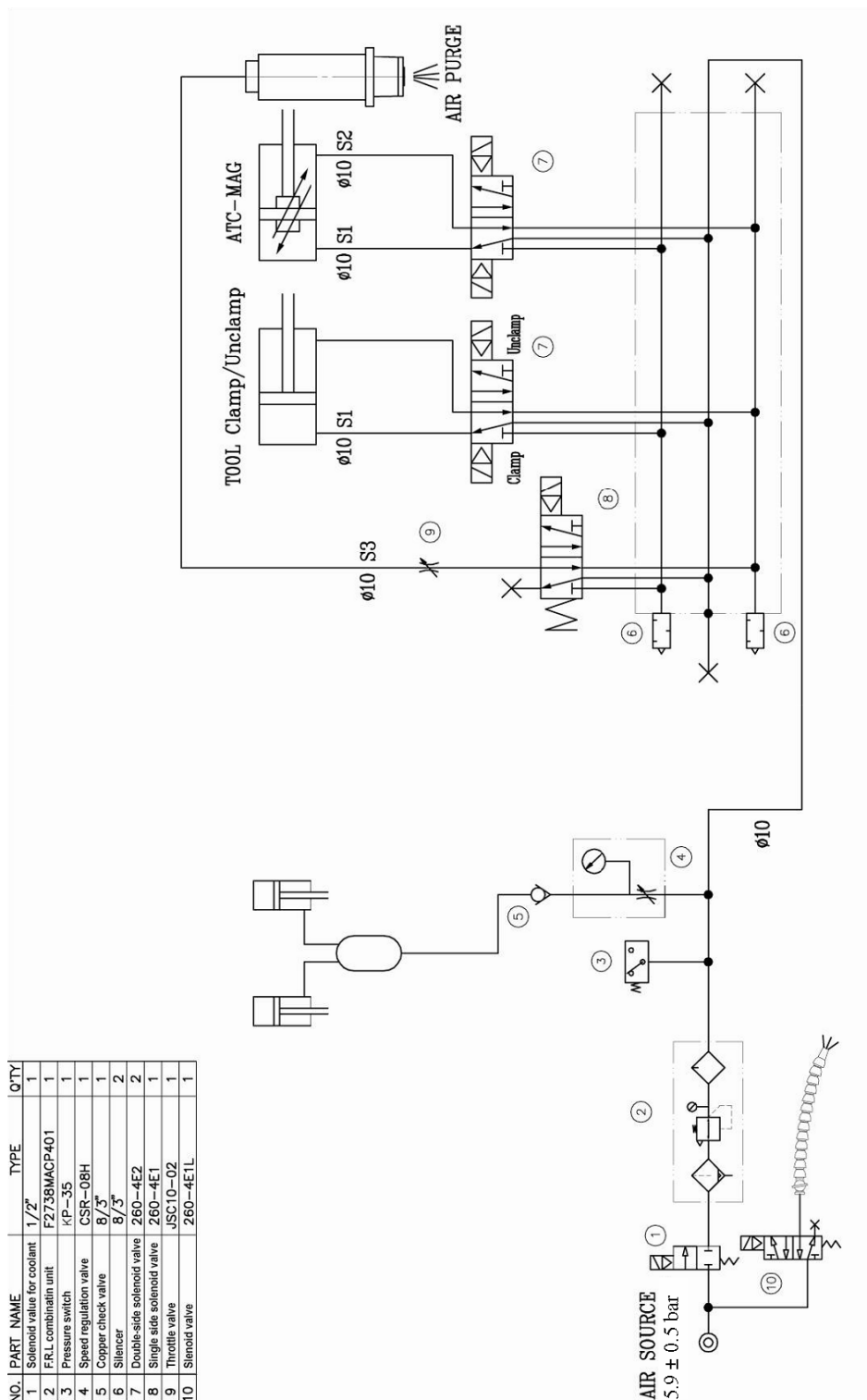
## 2.6. Air Circuit Diagram (With Linear Scale/With Labyrinth Air Blast)



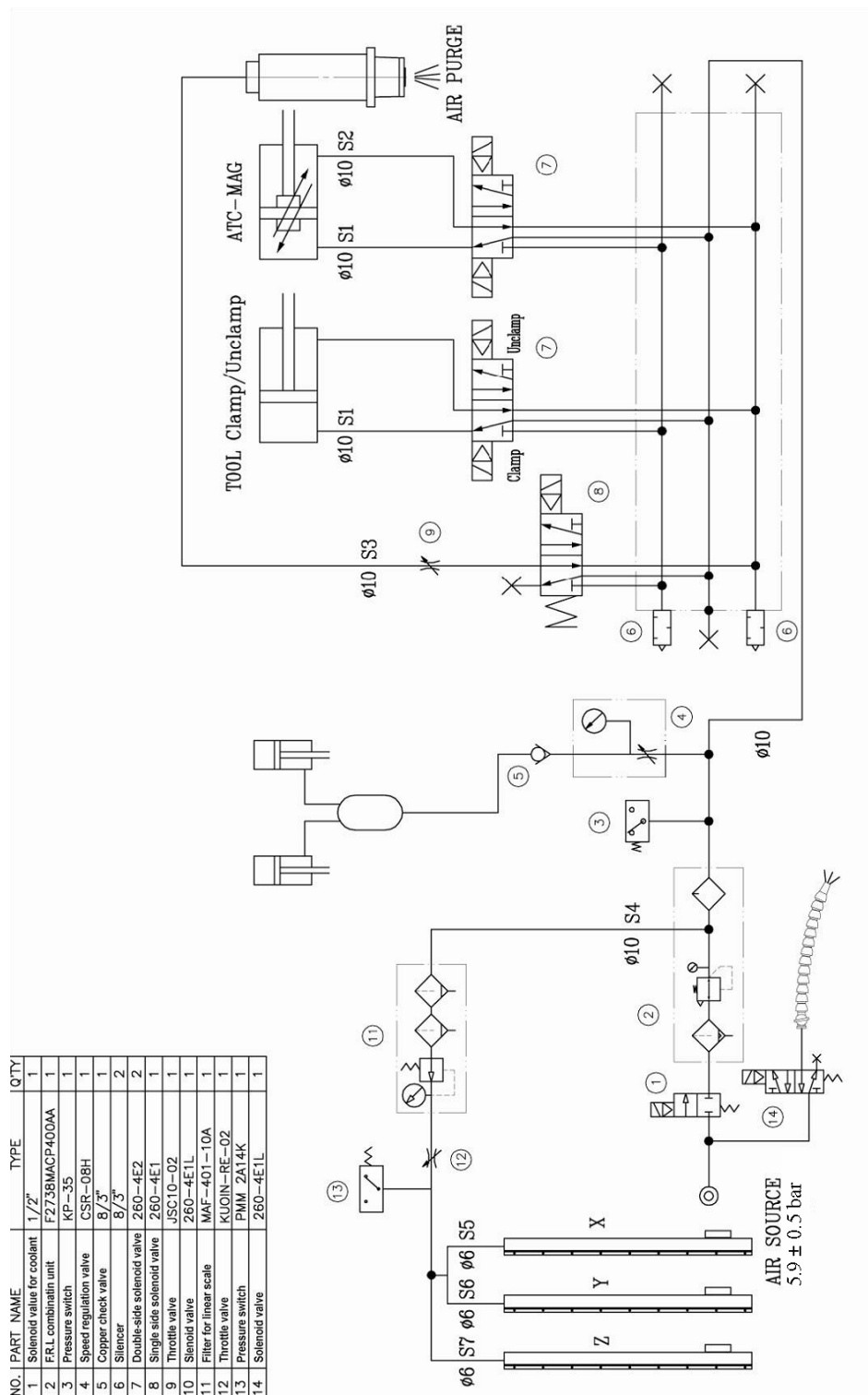
## 2.7. Air Circuit Diagram (Without Linear Scale/With Labyrinth Air Blast)



## 2.8. Air Circuit Diagram (Without Linear Scale/Without Labyrinth Air Blast)

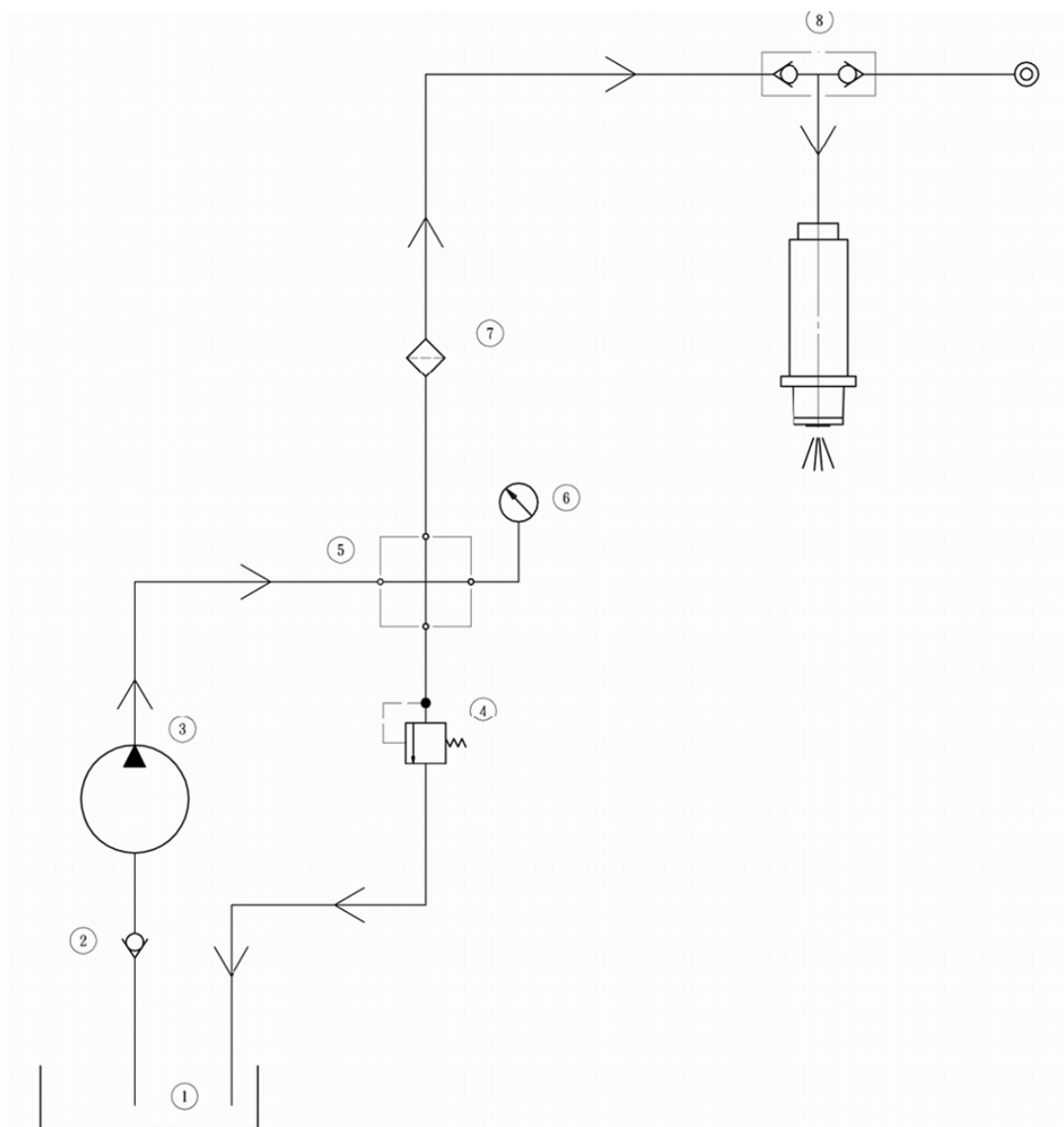


## 2.9. Air Circuit Diagram (With Linear Scale/Without Labyrinth Air Blast)



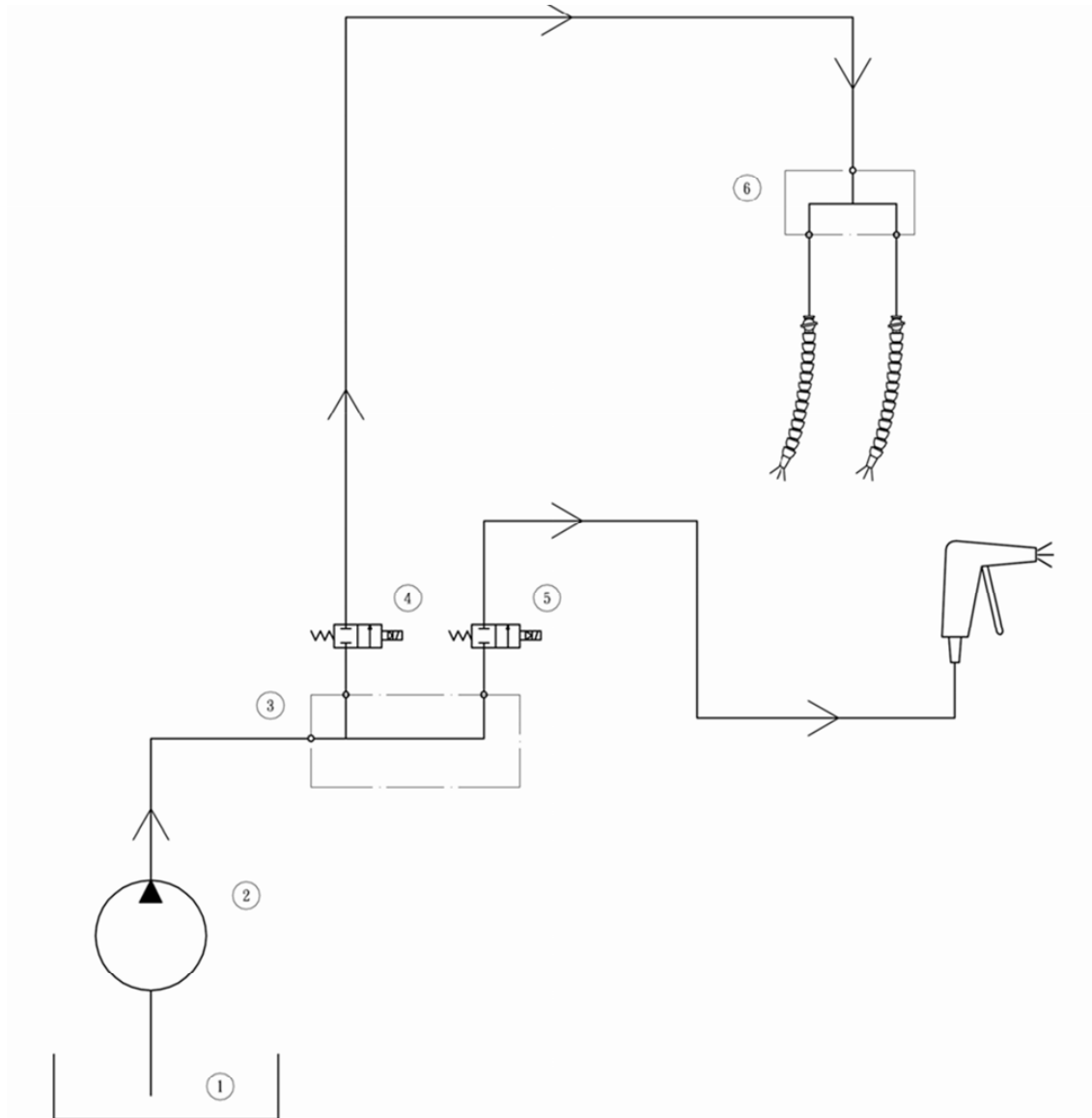


## 2.10. Central Cooling Circuit diagram



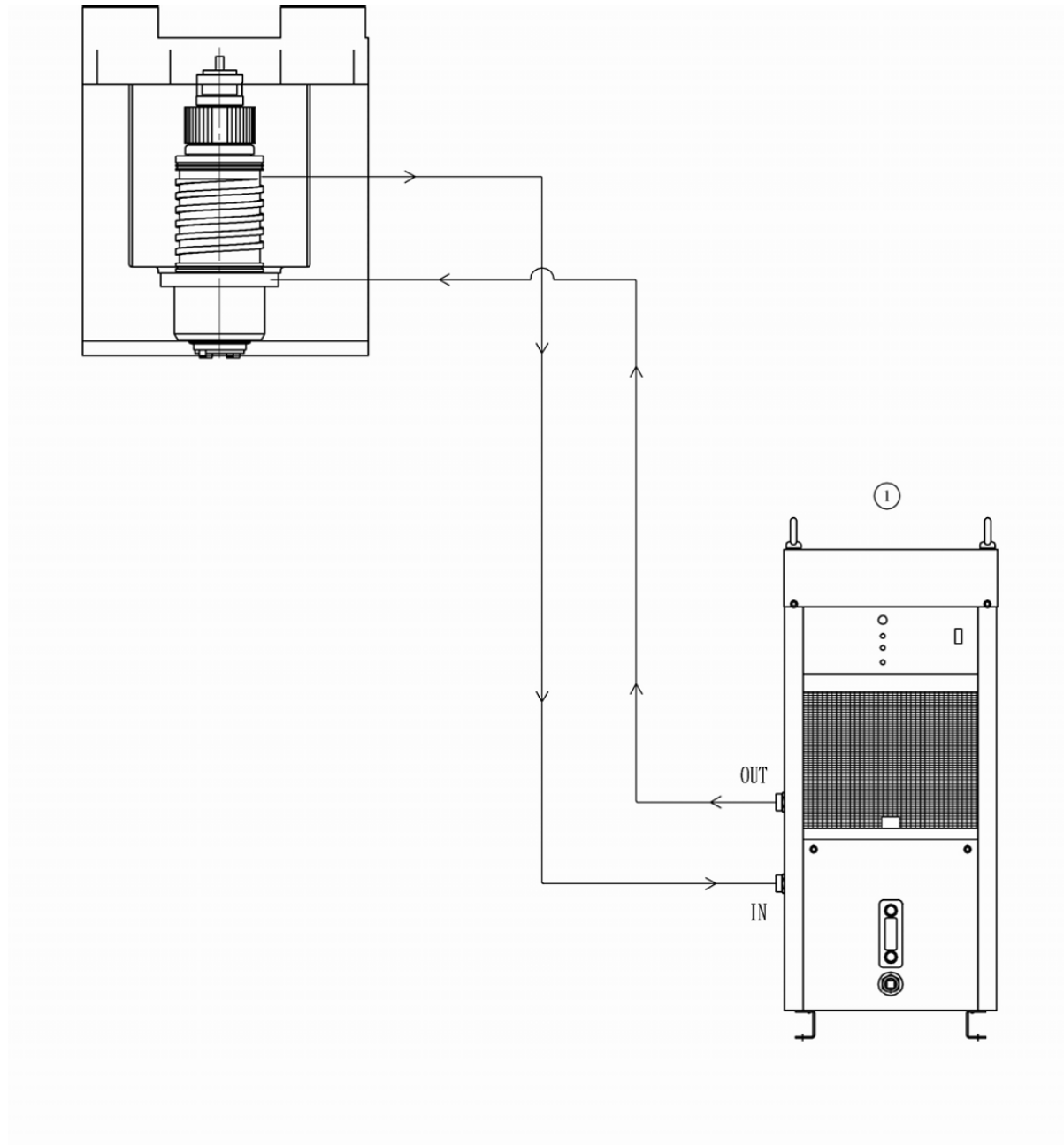
8	Shuttle valve	03T-30 BAR	1
7	Filter	Mahle Pi 2015-58 150L/25 $\mu$	1
6	Pressure gauge	1/4x2" x15kg/cm <sup>2</sup>	1
5	Distributor	315067	1
4	Pressure relief valve	15 BAR	1
3	Pump	CR1-23	1
2	Bronze check valve	1"	1
1	Coolant tank	2701HI100600	1
NO.	PART NAME	TYPE	Q' TY

## 2.11. Cutting Coolant Circuit Diagram



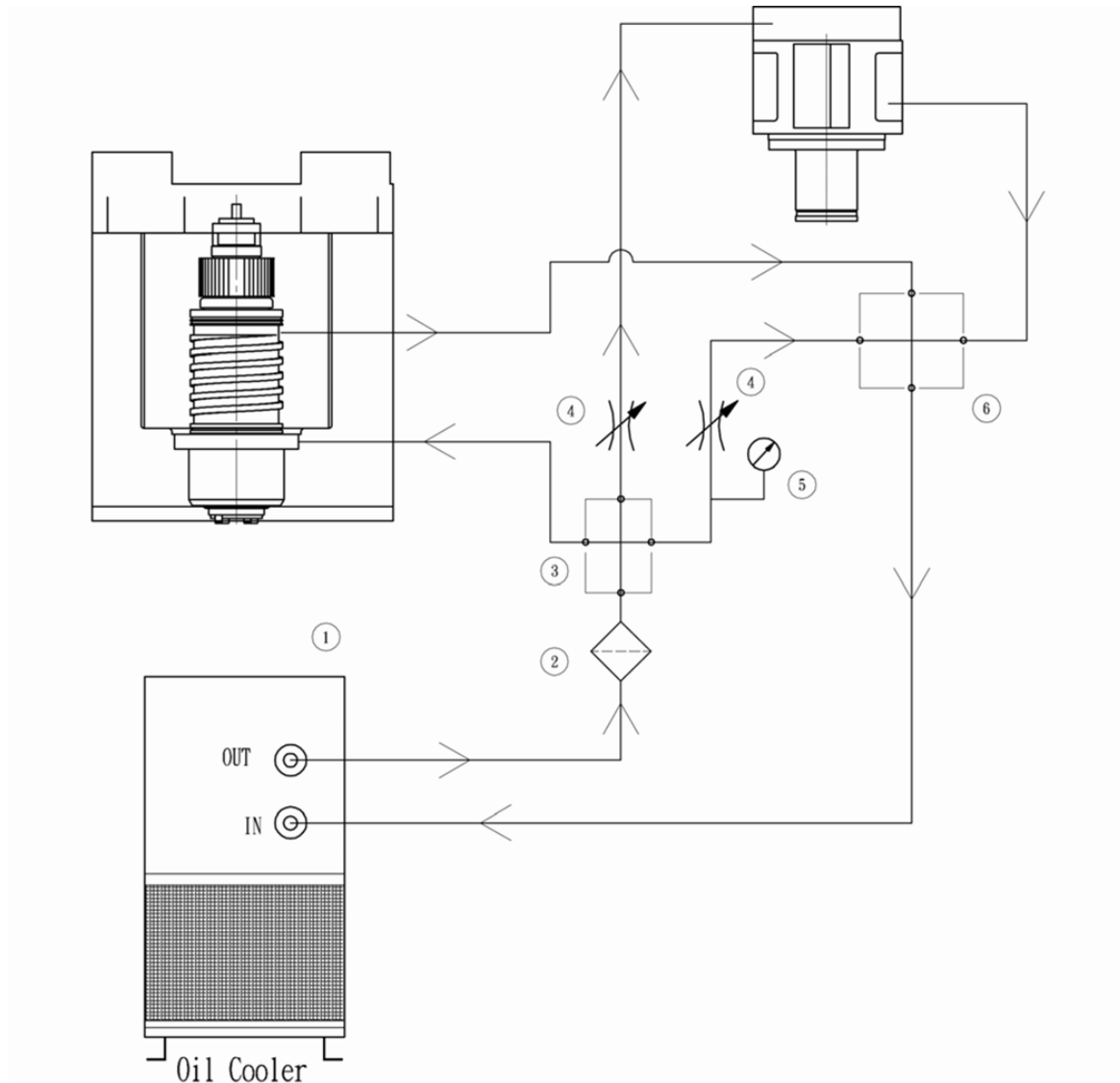
8			
7			
6	Distributor	305048	1
5	Solenoid valve for coolant	1/2"	1
4	Solenoid valve for coolant	3/4"	1
3	Distributor	405037	1
2	Pump	MTH-4	1
1	Coolant tank	2701H1100600	1
NO.	PART NAME	TYPE	Q' TY

## 2.12. Spindle Oil Cooling Circuit Diagram (Without ZF Gearbox)



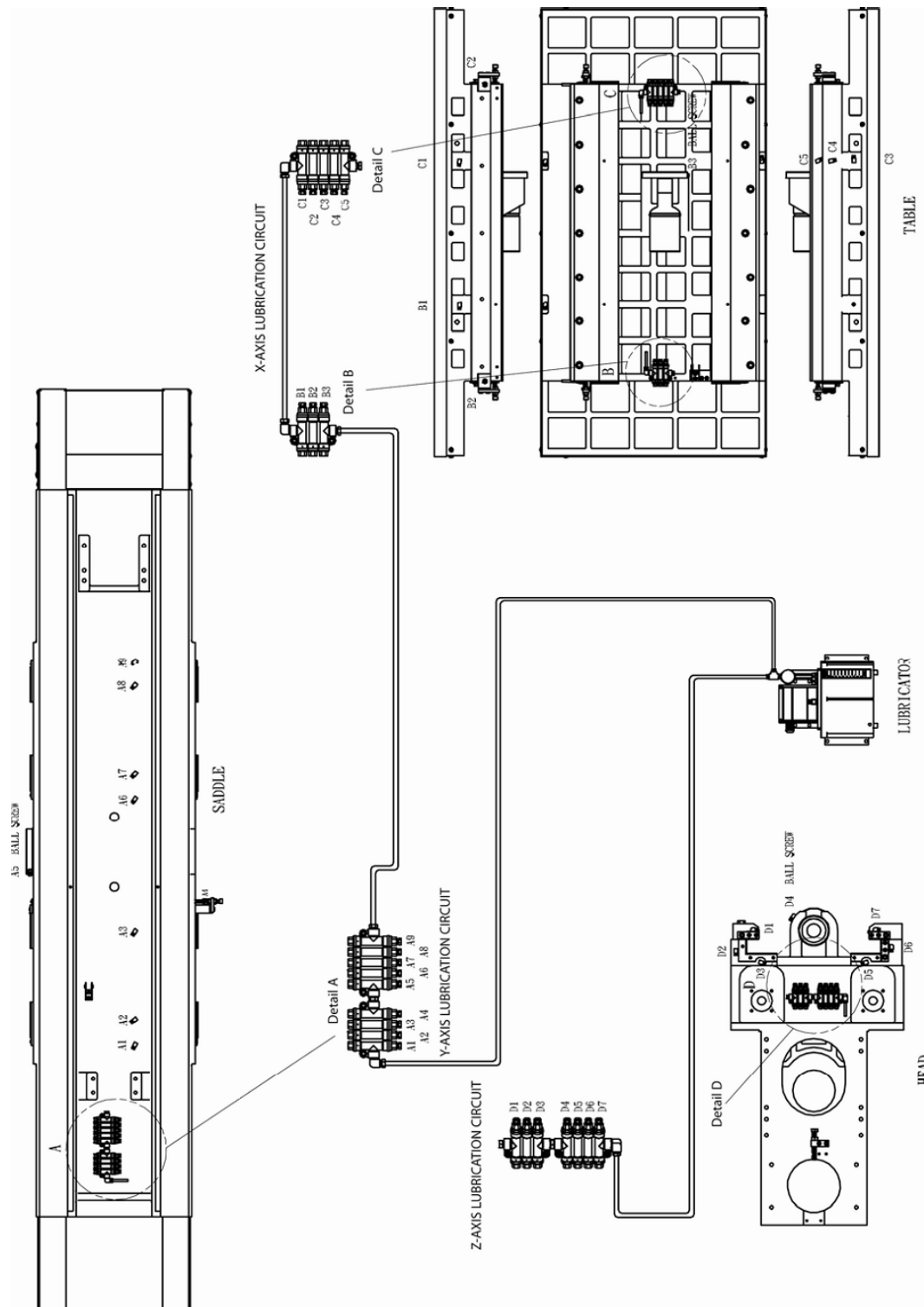
3			
2			
1	Oil Cooler	HBO-250PT	1
NO.	PART NAME	TYPE	Q' TY

### 2.13. Spindle Oil Cooling Circuit Diagram (With ZF Gearbox)



8			
7			
6	Pressure gauge	AB31-63/0-250K	1
5	Auxiliary oil tank for ZF Gearbox	2705C1100100	1
4	Throttle valve	3/8"	2
3	Distributor	125045	1
2	Filter	3/4"	1
1	Oil cooler	HBO-400PSB	1
NO.	PART NAME	TYPE	Q' TY

## 2.14. X,Y,Z-Axis Lubrication Circuit Diagram



### 3. MOVING MACHINE

#### 3.1. Unpacking and lifting

##### 3.1.1. Unpacking the machine

All machines to be exported have been rust-prevention treated and well packed before shipment. Upon receiving the machine, customer needs to carefully unpack the machine and remove all fixing blocks.

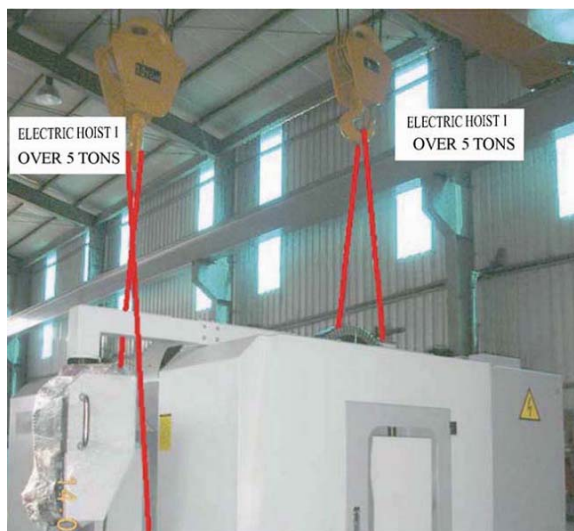
Unpacking the machine according to following procedures:

1. First remove the rust-preventative plastic bags.
2. Remove all fixing wood blocks and ropes that fasten all equipment, such as coolant tank, chip cart, motors and air cylinder brackets etc.
3. Move (lift) all equipment from the pallet.
4. Loosen all nuts that fasten the machine base to the pallet.
5. Prepare proper lifting equipment and steel wire ropes for lifting the machine from the pallet.

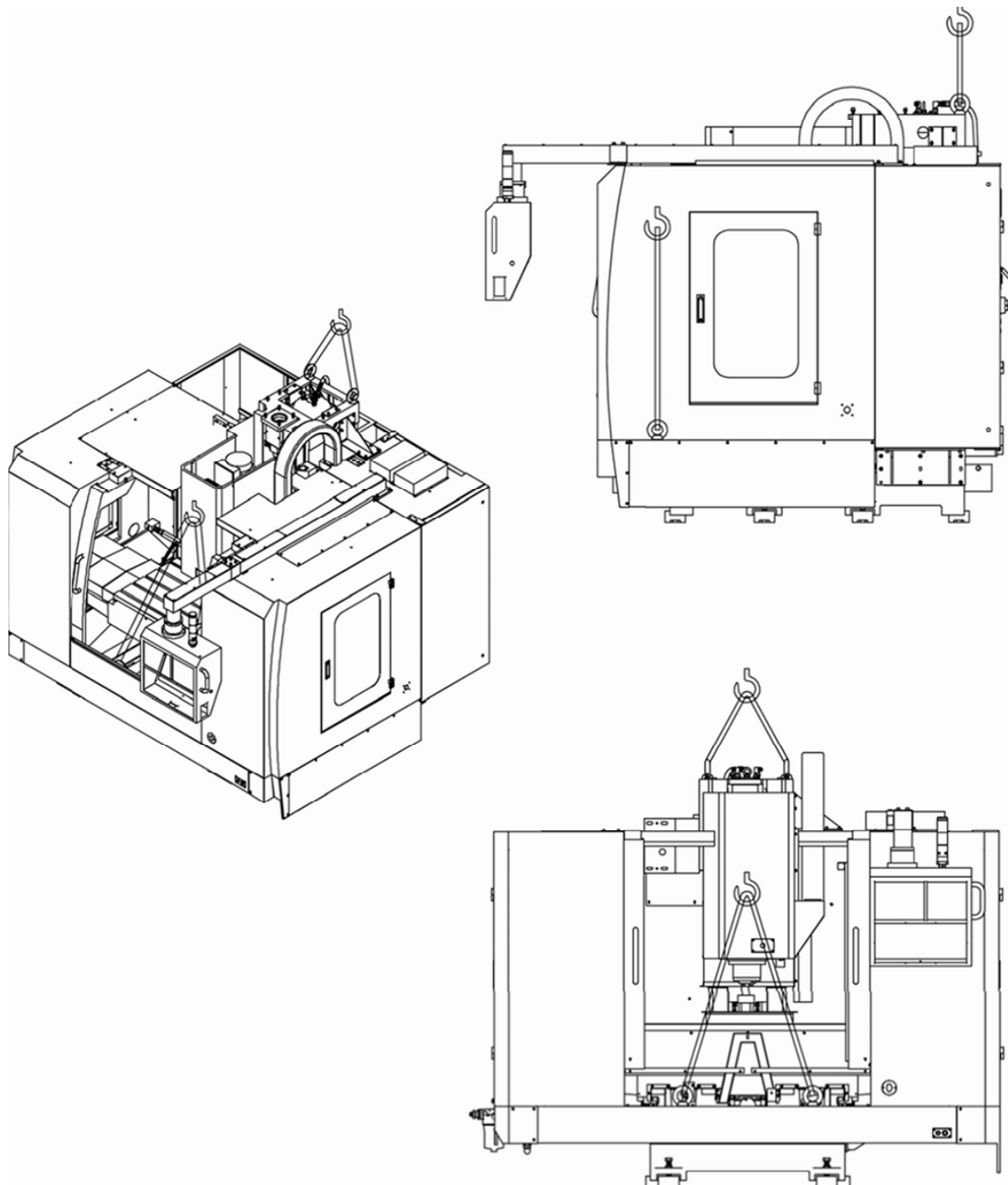
##### 3.1.2. Lifting the machine

Apply electric hoists or forklift for lifting the machine. During lifting, make sure the machine is well balanced and gravity center is located at proper position. The lifting equipment and steel wire ropes must resist over 10 tons of load.

As the lifting positions of the machine and lifting steel wire ropes may interfere with the splash guard of the machine, a proper lifting equipment or two sets of electric hoists shall be applied for lifting the machine.



## Machine Lifting Drawings



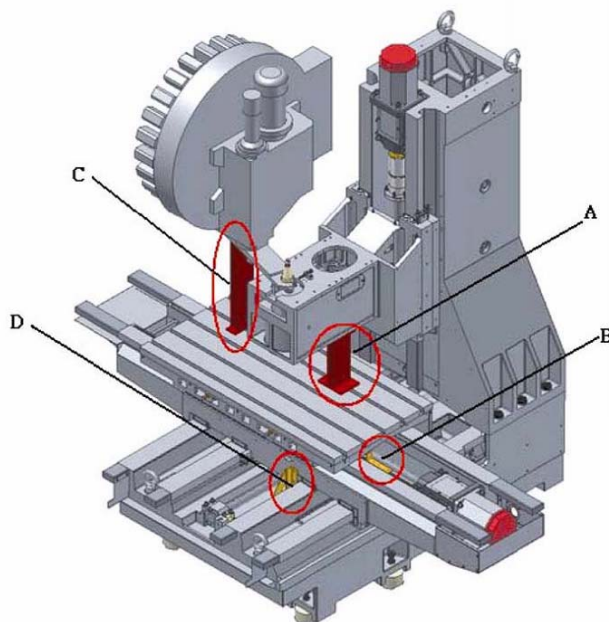


### 3.2. Placing the Machine

1. Move the machine to your desired work site. At this time do not Place the machine on the concrete floor until the leveling blocks have been adjusted to proper positions. Then you can place the machine on the floor.
  - When deciding the occupied area of the machine, make sure the electrical cabinet door can be opened freely.
  - Make sure the leveling blocks and leveling screws must joint together completely.
2. Install supplied equipment to the machine, such as spindle oil cooler, hydraulic tank for 4th axis and motors (including oil hose and power wires).
3. Check power source of the user's factory (Voltage fluctuation should be kept within  $\pm 10$  V. Air source pressure 6.4 bar)
  - In case power source voltage is unstable, you need to fit with a volt stabilizer. Do not immediately turn power on and operate the machine. Failure to comply may result in abnormal motion or parts damage.
  - Use only steel tube or rigid tube to connect the machine to an air source. Do not use flexible air hose, because it may unstable motions of spindle tool clamping/unclamping and tool change.
4. Connect power wires and air source to the machine. Then turn on the no-fuse breaker located at the back side of electrical cabinet. Make sure the three phase R, S, T, are connected correctly.
5. When power is turned on, set the machine at handwheel operation mode. At this time do not move any mechanisms to avoid the danger of parts colliding.
6. Remove all fix blocks in order.

### 3.3. Removing Fixing Blocks

#### 3.3.1. Fixing Blocks for Machine Mechanisms



##### A. Spindle Head Fixing Block

To remove the spindle head fixing block, turn power on, the air pressure reaches normal value and set the machine at hand wheel operation mode at control panel make sure there is no interference between parts. Use the hand wheel to slowly move z-axis upward until the spindle head releases from the fixing block. Then you can remove the fixing block together with the lock screws that fasten the spindle head to the table.

##### B. Table Fixing Block

Once the machine has been placed on the work site, loosen and remove the screws.

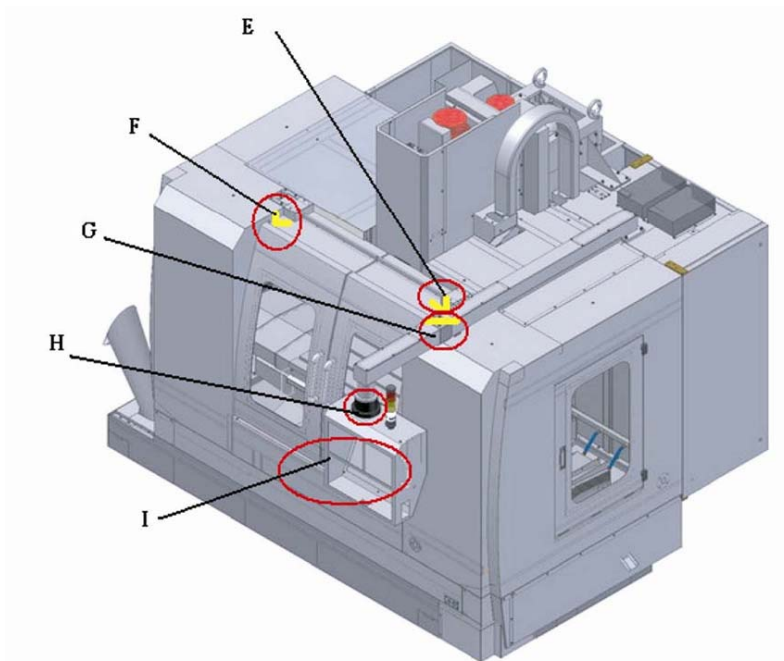
##### C. Tool Magazine Fixing Block

Once the machine has been placed on the work site, loosen and remove the screws.

##### D. Saddle Fixing Block

Once the machine has been placed on the work site, loosen and remove the screws.

### 3.4. Peripheral Mechanisms Fixing Blocks



#### **E. Fixing Block for Left Front Door**

Once the machine has been placed on the work site, loosen and remove the screws.

#### **F. Fixing Block for Right Front Door**

Once the machine has been placed on the work site, loosen and remove the screws.

#### **G. Control Box Overarm Fixing Block**

Once the machine has been placed on the work site, remove the control box fixing piece (H). Loosen and remove the lock screws of the fixing block. Pull the over-arm straight. Then tighten the fixing metal sheet.

#### **H. Control Box Lock Screw**

Simply loosen the lock screw without removing it.

#### **I. Control Box Fixing Block**

The control box is supported by on wood block. One end of the wood block is tightened to the table, and the other end supports the control box. Once the machine has been placed on the work site, loosen and remove the screws.

## **4. INSTALLING MACHINE**

### **4.1. General Requirements of Installation**

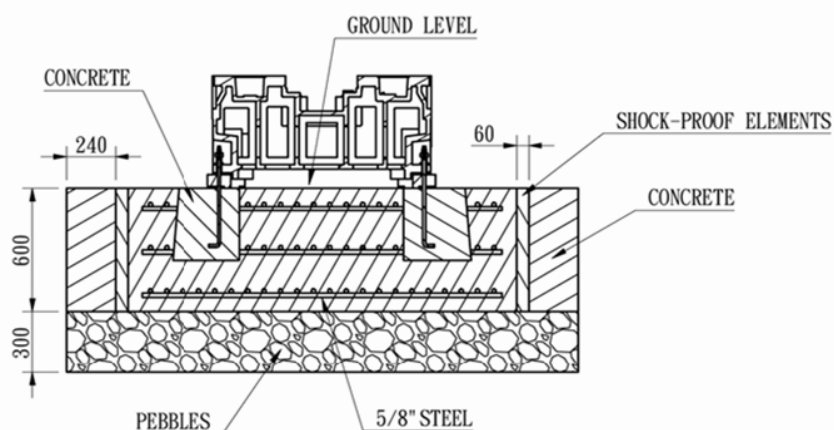
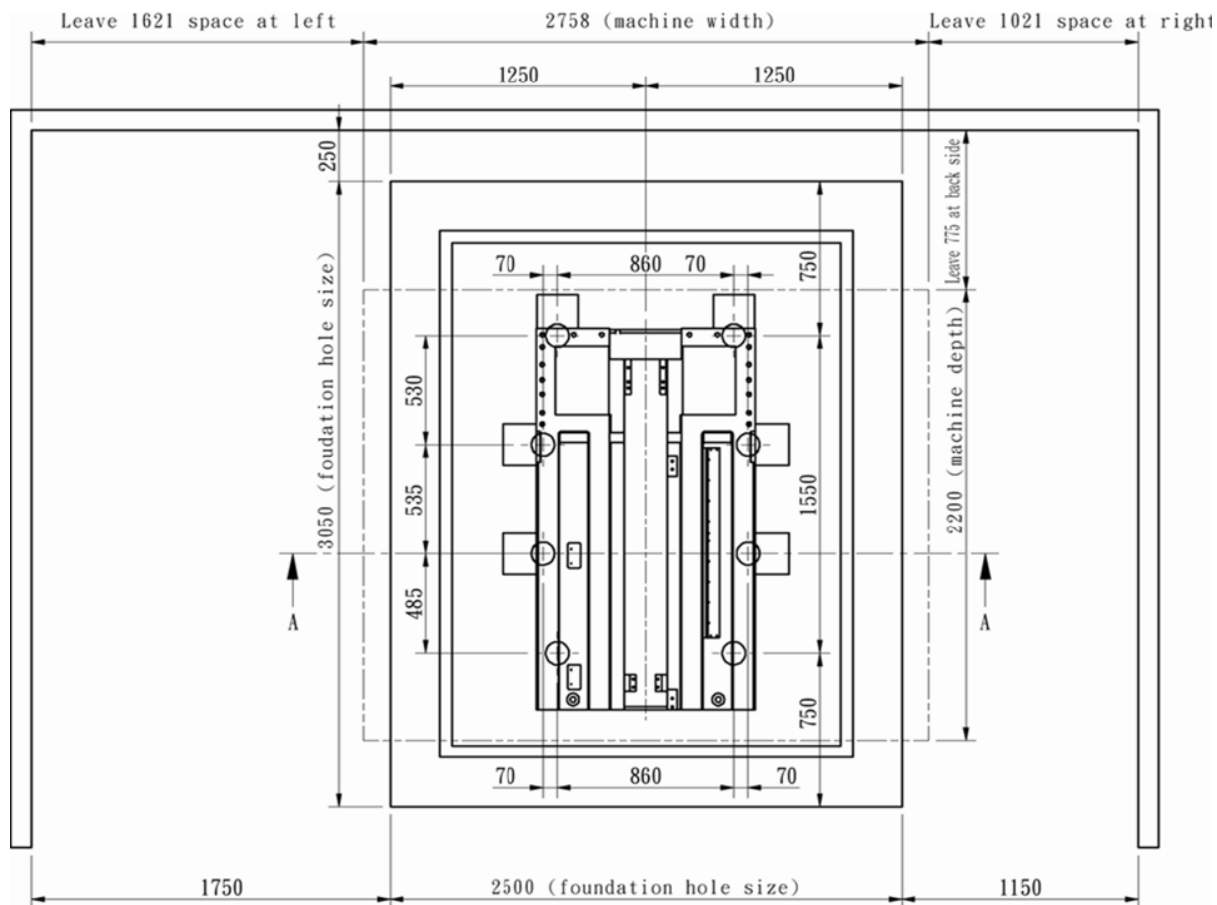
#### **Environmental Conditions of Installation Site**

- To ensure the best performance of operation, some foreign factors that may affect the machine's performance should be cared, such as room temperature, dusts and vibration.
- Installing the machine in an environment with great temperature difference may seriously affect the machine accuracy.
- Carefully select the machine installation location. Always keep the machine from direct sunshine and keep it away from a heating source, such as heat exchanger etc.
- Dusts and moisture may affect the operational performance of NC control. Pay special attention to operational environment of NC control.
- Vibration will affect the machine accuracy. Keep the machine away from a vibrating source.
- If the machine must be installed in a moisturized or polluted environment, care should be taken for the slide ways of the machine and electric control. Always prevent them from corroding or wearing. Sideways and electric control may be seriously affected by the moisturized or polluted environment.
- Make sure the foundation work is made properly to ensure the machine's accuracy and dependability.

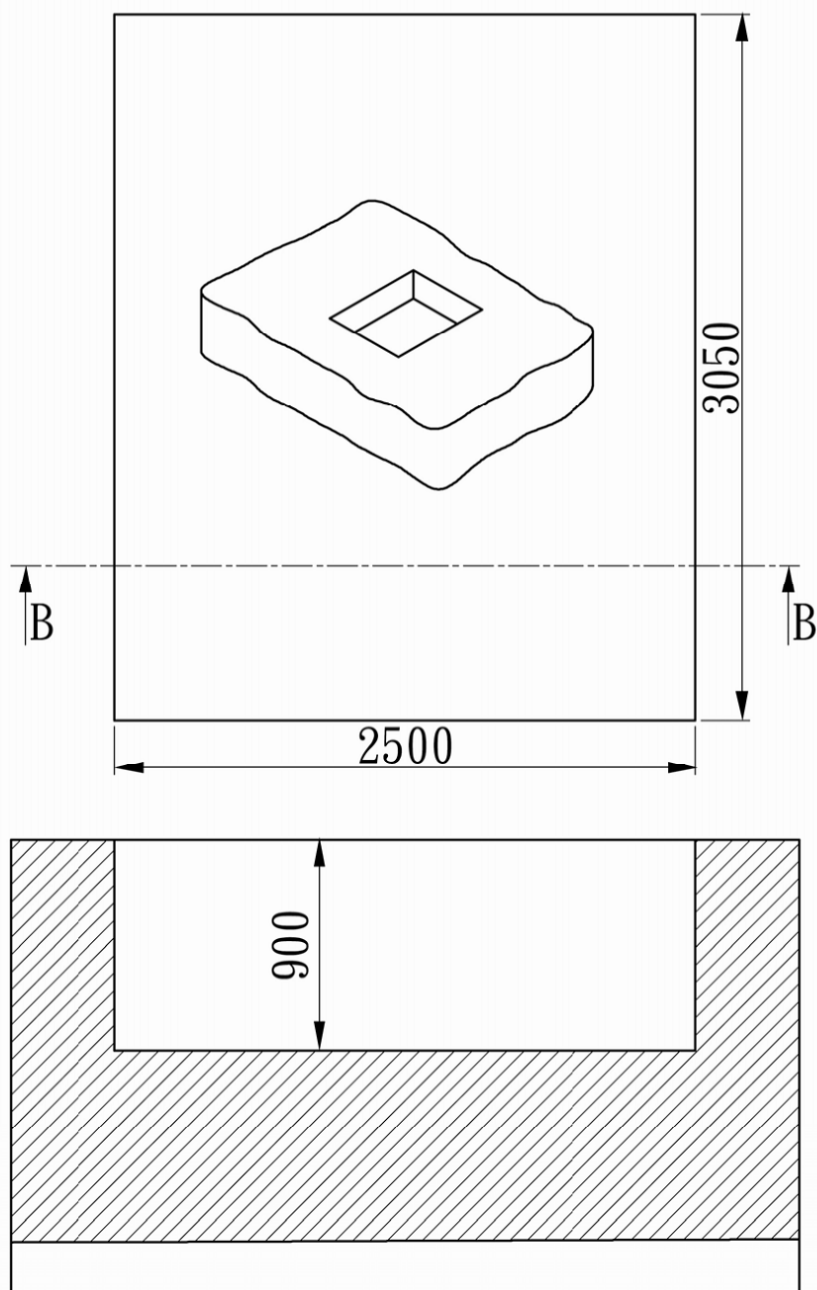
#### **Foundation Requirements**

- The thickness of concrete must be over 500mm.
- Fill with over 300 mm of pebbles under the concrete.
- Keep foundation plane accuracy within 5 mm.
- Foundation loading capacity must exceed 5 tons/m<sup>2</sup>
- The foundation work should be performed 4 weeks before installing the machine.
- The concrete mixing ratio is cement: sand: stone=1:2:4. Once concrete is filled into the foundation, keep it moist for some days.

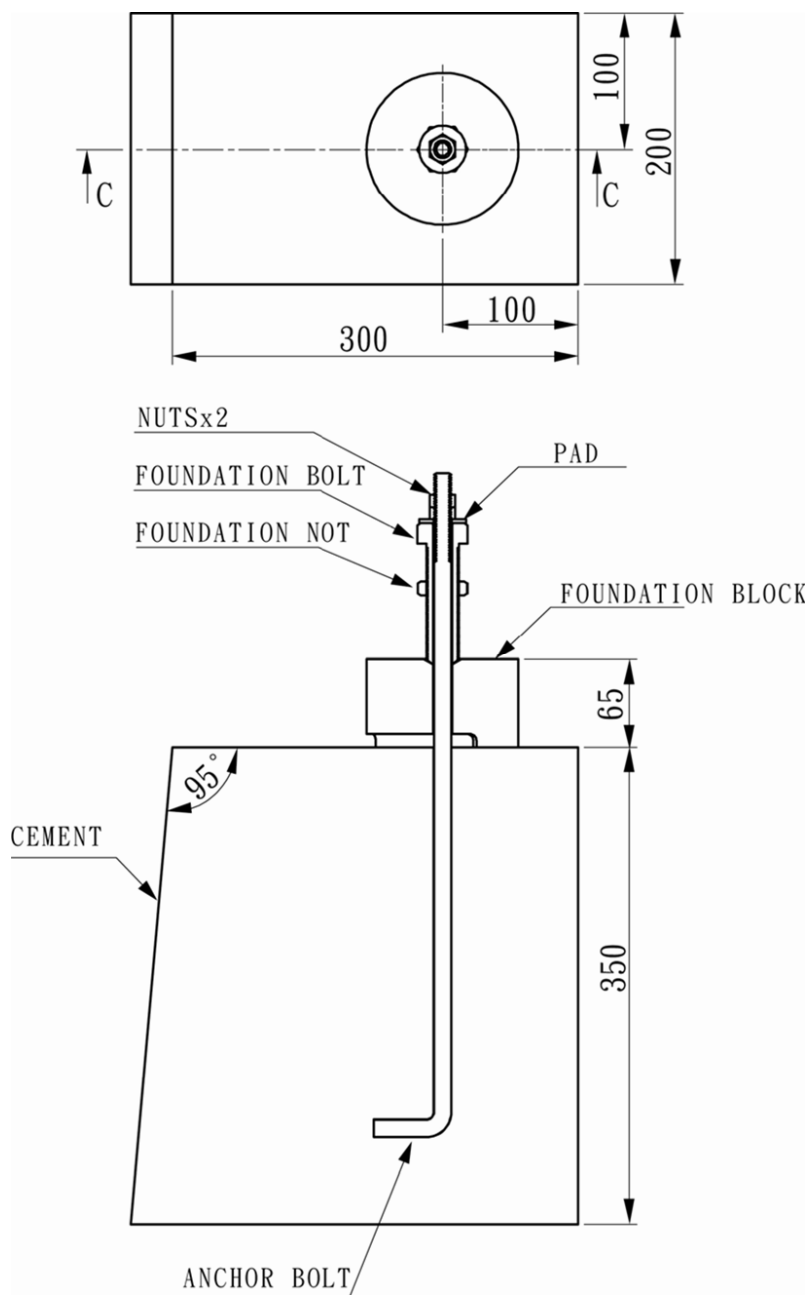
## 4.2. Foundation Plan



#### 4.3. Dimensional Drawing of Foundation Hole

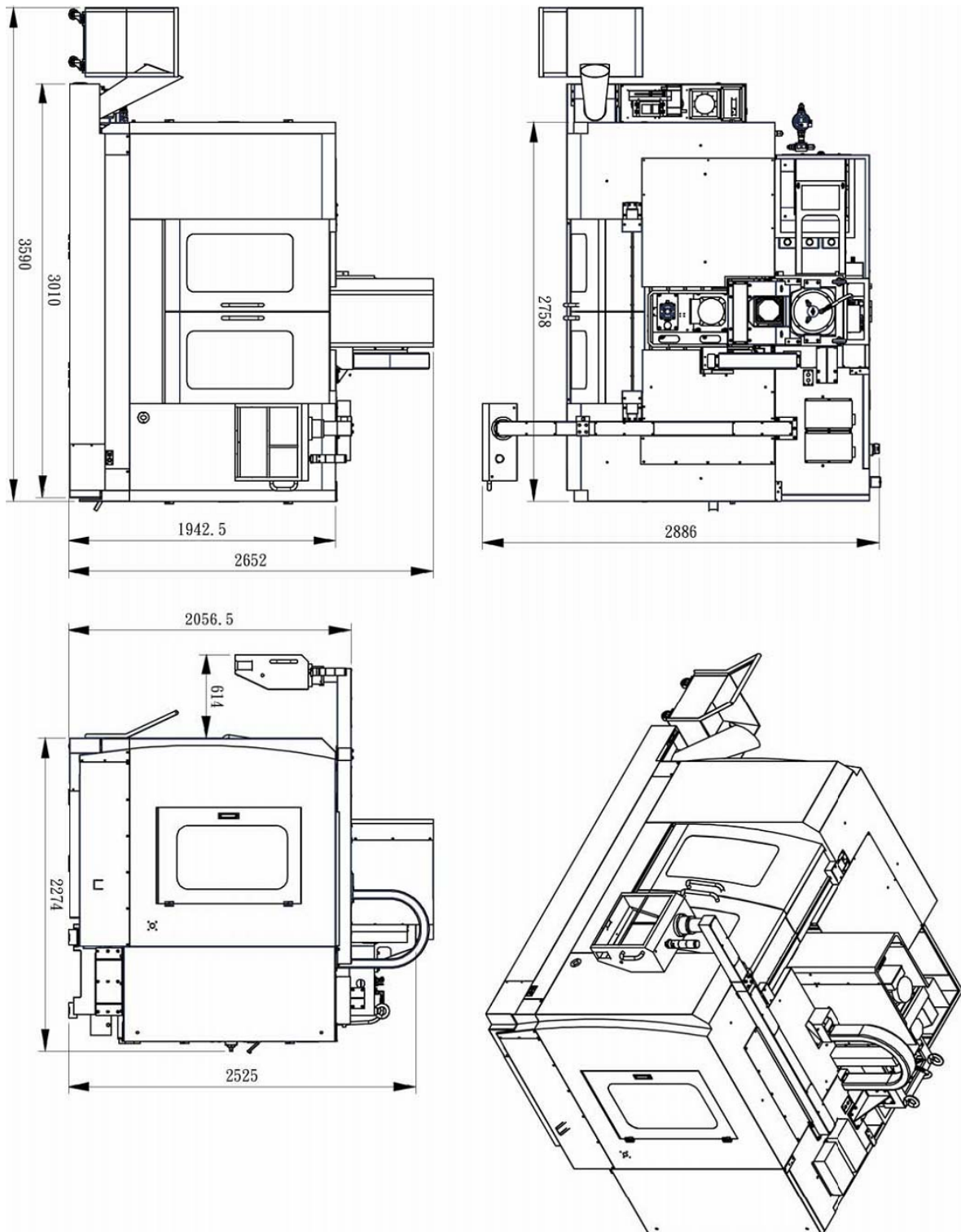


#### 4.4. Installing Drawing of Anchor Bolt

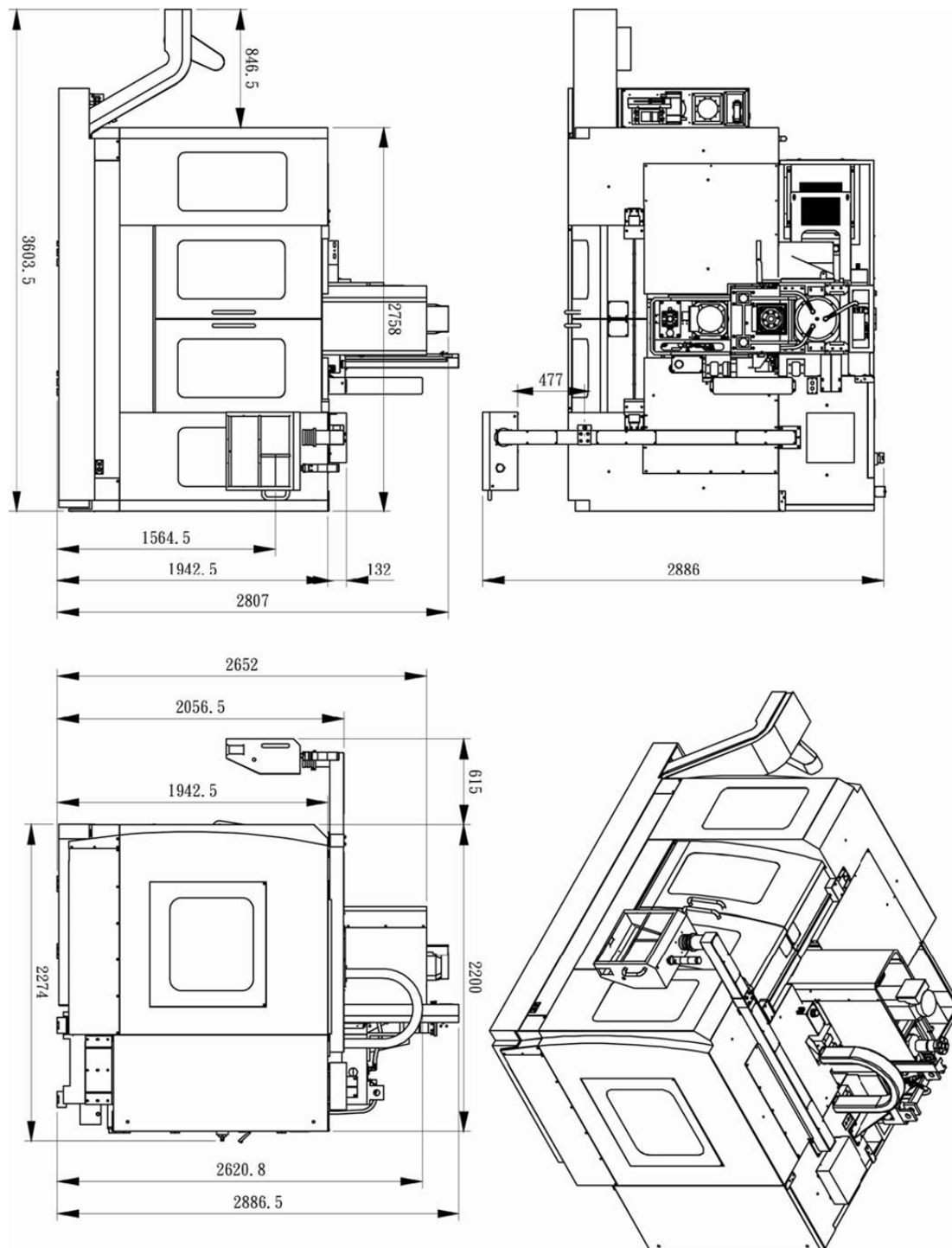




#### 4.5. Dimensional Drawings of Machine (option)



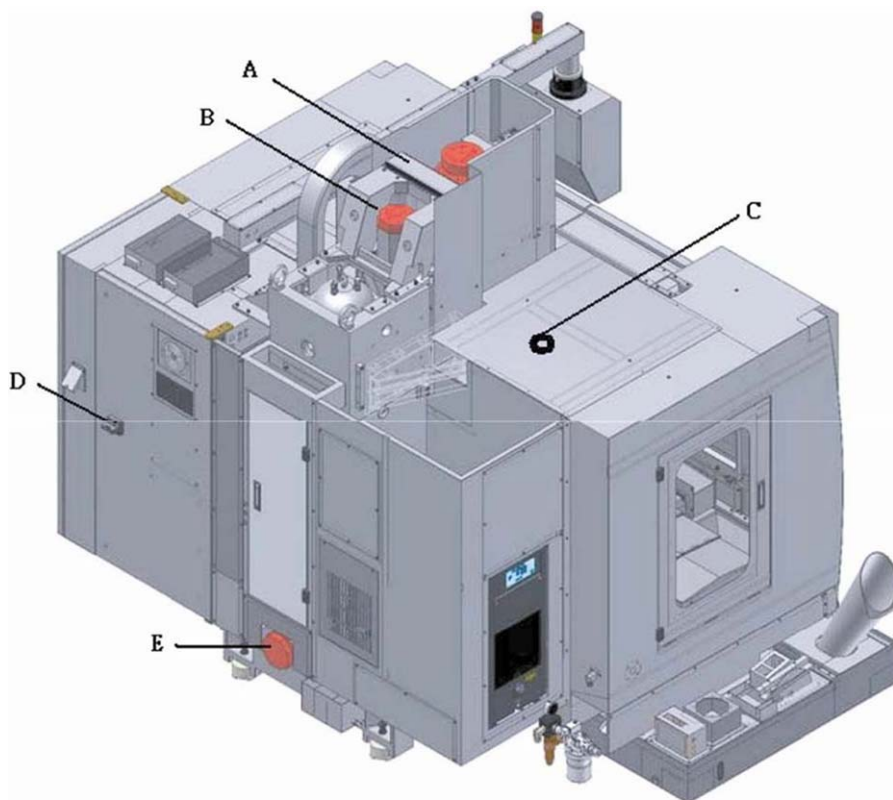
## Dimensional Drawings of Machine



## 4.6. Installing Machine on Foundation

### 4.6.1. Parts Dismantled Before Shipment

The machine has been well assembled and tested however some parts will be dismantled before shipment to meet the requirement of packing and transportation. When installing the machine, you need to install these dismantled parts to their positions. Below figure shows the dismantled parts names and their positions.



**A – AIR CYLINDER BRACKET**

**B – Z-AXIS MOTOR**

**C – MAGAZINE MOTOR**

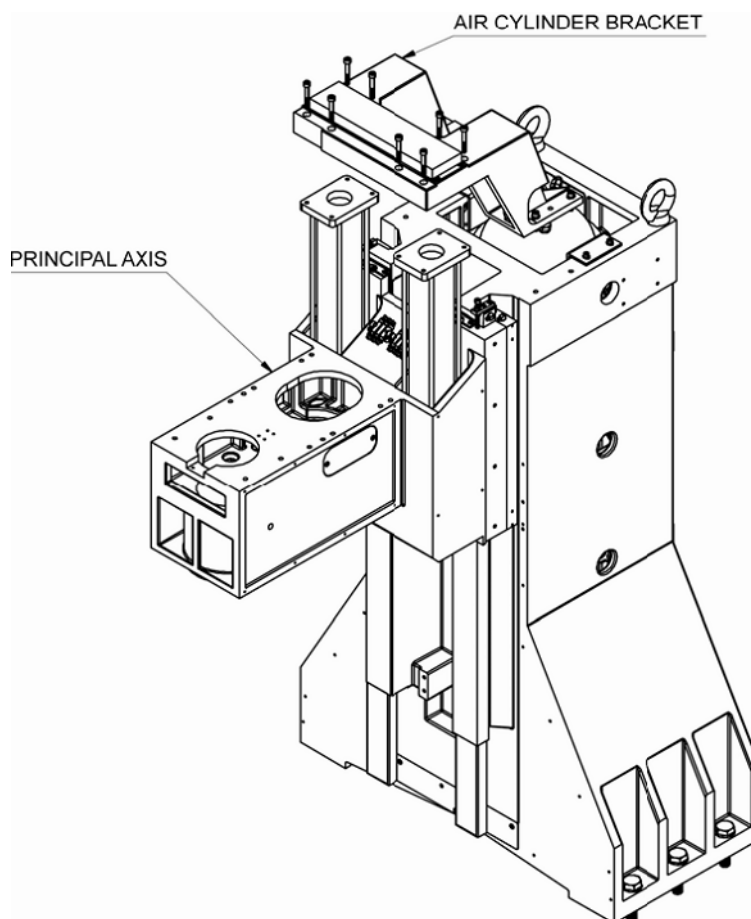
**D – POWER SWITCH HOLDER**

**E – Y-AXIS MOTOR**

Sometimes some small parts may be dismantled, such as front door handle, air inlet connector and coolant gun etc. Simply fit these small parts to their positions. No additional instructions will be given for fitting these small parts.

#### 4.6.2. Installing Machine Parts

Installing the machine parts after the machine has been well installed on the foundation. Especially the installation jobs for air cylinder and air cylinder bracket are performed only after power is turned on. The installation procedures are shown as below:



1. Mounting power switch holder.
2. Mounting Y-axis motor. Pay attention to marking on the coupling for motor end and screw end. Align with marking then tighten the motor lock screw.
3. Mounting magazine motor. Pay attention to the keyway positions on motor end and shaft end.
4. Mounting air cylinder bracket. Before tightening screws, be sure to knock positioning pin into the air cylinder bracket and column.
5. Mounting Z-axis motor. Pay attention to marking on the coupling for motor end and screw end. Align with marking then tighten the motor lock screw.
6. Mounting air cylinder to air cylinder bracket. Once power is turned on manually moves Z-axis to approach positive limit position. Raise the right and left air cylinder, then tighten screws evenly.

#### **4.6.3. Power Source Required**

- Customer is requested to connect the power wires from the machine to the power source. The sectional area of a single wire should be bigger than  $8\text{mm}^2$ . The sectional area of a ground wire also should be bigger than  $8\text{mm}^2$ .
- Power Source:  $400\text{ V}\pm 10\%$  in European area;  $380\pm 10\%$  in China area;  $200\text{ V}\pm 10\%$  in Taiwan and U.S.A. In addition to countries with  $220\text{ V}$  (Volt change is not required), customers in another areas should consider to order extra transformer (optional).
- Power Source Capacity:  $25\text{ kVA}$ .

#### **4.6.4. Air Source Required**

- This machine applies air for cleaning spindle hole, positive pressure of spindle bearings, spindle tool clamping. Magazine motion and auto door of ATC. Customer needs to prepare a proper air source.
- Air Pressure:  $6.5\text{--}8.0\text{ bar}$ .
- Air Flow:  $500\text{ l/min}$ . ( $130\text{ gal./min.}$ )
- To avoid serious variation of air temperature and reduce air entering into the mechanisms of machine, it is suggested to equip with one set of air dryer between the air source and the machine.

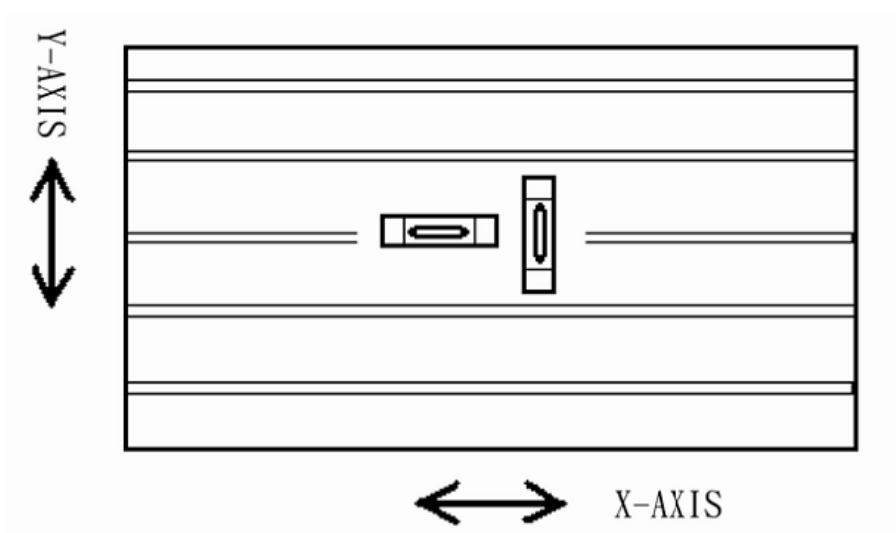
#### **4.7. Leveling Adjustment**

Machine leveling condition is a critical factor that may decide the machine accuracy. Maintaining accurate and stable machine leveling will ensure the machine accuracy and its service life. Adjusting the machine leveling according to following procedures:

1. Install the machine on the foundation and roughly adjust the machine leveling by turning the leveling adjustment screws.
2. Apply two precision level gauges with accuracy  $0.02\text{ mm/graduation}$  for checking leveling adjustment.
3. Make sure both level gauges have been accurately leveled before making leveling adjustment.
4. Return X, Y, Z-axis to their home positions, then move 3 axes to their center points of travels.
5. Place the precision level gauges on the center of table.
6. Turn the foundation bolts until the air bubble reaches the center position. Move y-axis to the positive and negative limit position, and adjust leveling until the leveling of X-Z plane is within  $0.02\text{ mm/m}$  (about 1 graduation).
7. Make sure each foundation bolt has tightly contacted the foundation block.

8. Tighten the nut on each foundation bolt securely.

If machine vibration occurs due to unbalance or intermittent cutting mark creates, then it is necessary to adjust the leveling screws. For a newly installed machine, it is requested to inspect the machine leveling condition everyday for a period of 2-3 days. Inspect the machine leveling condition every month for a period of half year. Afterward, inspect leveling condition every 3 months.



## **5. INSPECTION ITEMS & PROCEDURES FOR POWER ON**

### **5.1. Inspection Items & Procedures for First Time Power On**

#### **Inspection before Power On**

1. Leave proper spaces around the machine for maintenance and cleaning.
2. All equipment and parts supplied together with the machine must be installed completely (such as brackets and motors etc.).
3. Remove all fixing blocks and interfering objects. Note that the fixing block for spindle head can be removed after power is turned on.
4. Make sure voltage and Hz are correct (400 V/50 Hz).
5. Check if power source capacity (25 kVA) is sufficient or not.
6. Air pressure must be over 5.88 bar. Air flow must be over 500 l/min.
7. Check if lubrication oil and coolant amount are sufficient or not.

#### **Inspection after Power On**

1. After power on, first check if emergency stop switches work normally or not.
2. Check if running directions of coolant motor and chip conveyor motor are correct or not.
3. Check if running directions of the fan of oil cooler is correct or not. The air should such from the filter screen side.
4. After the power on procedures are performed correctly, set the machine at handwheel operation mode.
5. Make sure there is no obstacle existed in the machine, then move z-axis upward and remove the spindle head fixing block.
6. Use handwheel control to move X, Y, Z-axis to approach their limit positions and check if there is interference or not.
7. Turn the mode selection knob to home position return mode, and perform home position return on 3 axes (Tool magazine moves together).
8. Adjust the machine leveling and geometric accuracy (Performed only by experienced technician of the NCT Ltd.)
9. Test function of the control panel. Check if all keys and indication lamps work normally or not.
10. Perform spindle warm-up running and running test.
11. Perform full travel movements on X, Y, Z-axis.
12. Perform automatic tool change motions. (Make sure the tool change height and spindle orientating angle are correct).
13. Perform leak test for cutting fluid.



### **Check Documents**

Check Documents:

- Nc control standard manual
- Control panel operation manual
- Maintenance manual
- Electric wiring diagram
- Parts list
- Accuracy test report
- Other documents (such as operation manuals of oil cooler and tool magazine etc.)

Check Service Tools and Spare Parts:

- Simple maintenance tools
- Fuses

## **5.2. Power-On Inspection**

### **Inspection before Power-On**

- Check if power from transformer to the machine is 3 phase, 50/60Hz, 220V or not.
- Check if power from wire diameters input the machine are correct or not. Also, check if all phases are connected correctly or not.
- Check if grounding wires are properly connected.
- Check if all fixing blocks are removed or not, such as x-axis fixing block and z-axis fixing block etc.
- Check if all foundation bolts are tightened securely or not. Make sure the machine is in proper leveling condition.
- Check if all tubes are properly connected or not.
- Check if splash guard and safety door are in good condition.
- Check if slideways lubrication oil amount is sufficient or not.
- Check if hydraulic oil amount is sufficient or not.
- Check if there is any part on the spindle and the tool disc loosened or not.
- Check if all limit switches and stoppers work normally or not.
- Make sure there is no obstacle existed at vicinity of the machine.

Once power is turned on, the spindle motor fan starts running immediately which is not controlled by the emergency stop switch. Care should be taken to keep personnel and tool away from the fan running area before turning power on.

### **Inspection after Power-On**

- Check if hydraulic pump runs to a correct direction or not.
- Check if emergency stop motions are normal or not.
- Check if Power ON/OFF functions are normal or not. Use handwheel made to slowly raise the spindle head (up direction), then remove the spindle head fixing block.
- Check if all switches and buttons work normally or not.
- Slowly move each axis, at this time check if oil lubrication on slideways is normal or not.
- Slowly move each axis, and check if axis travel protection is normal or not.
- Check if home-position return function is normal or not.
- Check if the spindle running from low speed to high speed is normal or not.
- Check if safety door interlock function works normally or not.
- Check if program control function is normal or not.
- Check if there is oil leakage or not.

## **6. MAINTENANCE**

### **6.1. Periodic Maintenance**

#### **6.1.1. Daily Maintenance**

1. Clean the machine.
2. Fill Slideway oil.
3. Fill oil into filter/regulator/lubricator combination unit
4. Check if oil amount for spindle oil cooler is sufficient or not.
5. Check if oil amount in oil cup for tool knocking cylinder is sufficient or not.
6. Fill cutting fluid.
7. Check if air pressure is over 6.37 bar or not.
8. Drain accumulated water in filter/regulator/lubricator combination unit.
9. Check if spindle oil cooler works normally or not.
10. Clean the spindle taper and coat with a few of rust-preventative oil.

#### **6.1.2. Weekly Maintenance**

1. The weekly maintenance also includes all daily maintenance items.
2. Coat grease on the chain for counter-balance weight (Use brush for coating grease. This step can be neglected if the machine is not equipped with a counter-balance weight).
3. Shoot grease into the grease nipple for lubricating chain wheel shaft on counter-balance bracket (Use a grease gun for shooting grease. This step can be neglected if the machine is not equipped with a counter-balance weight)
4. Clean the filter screen in the slideway oil tank.
5. Periodically clean the coolant tank.
6. Check if air leakage occurs on the solenoid valves.
7. Check if there is any abnormal motion of automatic tool change.
8. Check if pressure for hydraulic power unit for 4th axis is sufficient or not (29.42 – 34.32 bar)
9. Fill oil into tool knocking cylinder (Circulation oil ISO VG 32)
10. Check if slideway oil is leaked or jammed.
11. Clean filter screens in the spindle oil cooler and heat exchanger of electric cabinet (air conditioning device).

### **6.1.3. Half-Yearly Maintenance**

1. The half-yearly maintenance also includes all weekly maintenance items.
2. Adjust gibs on Z-axis slideways.
3. Fill oil into the spindle oil cooler (ingot oil)
4. Fill oil into hydraulic oil tank for 4th axis. (Circulation oil ISO VG32).
5. Fill oil into gearbox for arm type magazine (gear oil).
6. Replace cutting fluid if necessary.
7. Clean interior of Slideway oil tank.
8. Adjust tool knocking amount for tool clamping/unclamping mechanism. (0.5-0.7 mm for #40 spindle. 0.7-0.9 mm for #50 spindle).
9. Check and adjust spindle belts.
10. Adjust the machine leveling.
11. Inspect and adjust the spindle pulling force (Over 6 kN for #40 spindle. Over 10 kN for #50 spindle).
12. Remove telescopic guards on 3 axes, then check if slideways are lack of oil or not.
13. Inspect backlashes on change parameters for 3 axes.

### **6.1.4. Yearly Maintenance**

1. The yearly maintenance also includes half-yearly maintenance items.
2. Replace gear oil for 4th axis (gear oil).
3. Replace oil for spindle oil cooler (ingot oil).
4. Replace oil of hydraulic oil tank for 4th axis (hydraulic oil or circulation oil).
5. Replace oil in gearbox for arm type magazine (gear oil).
6. Check if there is abnormal noise or not when 3 axes are moving.
7. Check if there is any abnormal noise or not when the spindle is running.

### **6.1.5. Responsible Personnel for Maintenance Job**

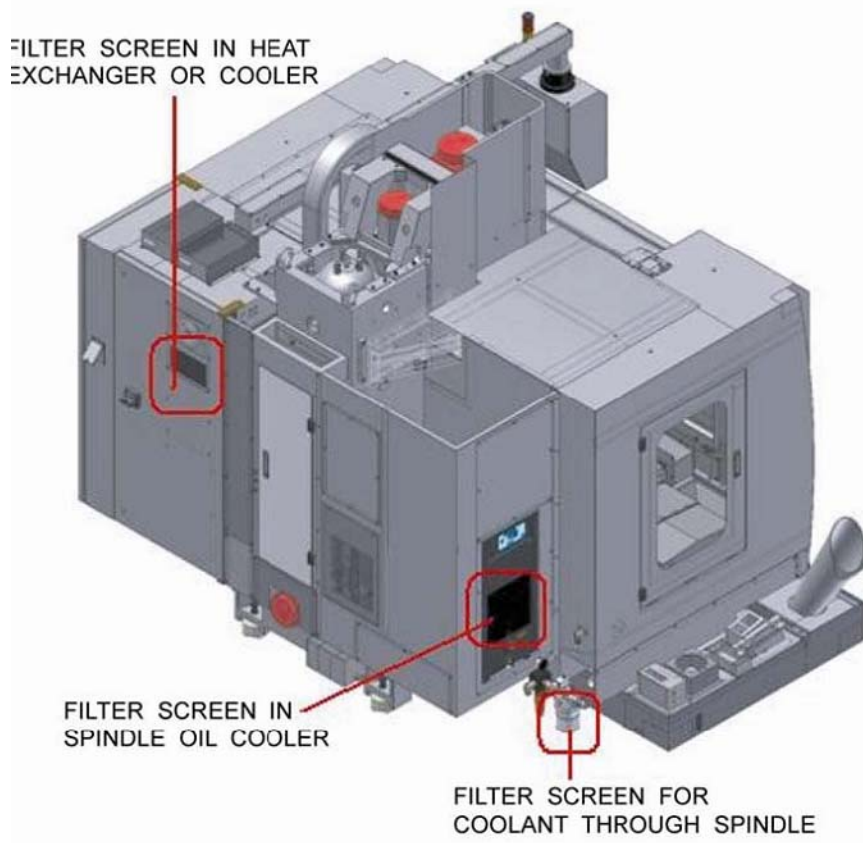
Basically the daily and weekly maintenance jobs are conducted by the operator.

The half-yearly and yearly maintenance jobs should be conducted by experienced personnel who have been well trained by the NCT Ltd.

- Note that if periodic maintenance is not conducted absolutely or abnormal operation of the machine, that may seriously affect the service life of machine.
- Above-mentioned maintenance jobs also include optional functions. If the machine does not have such function, its maintenance step may be neglected.

## 6.2. Key maintenance items

### 6.2.1. Clean Filter Screen



The filter screens for heat exchanger, air conditioning device and spindle oil cooler do not feature clean-sensing function, therefore they are requested to remove for periodic cleaning. A high pressure air can be applied for cleaning.

In case the filter screen for coolant through spindle device is jammed, an warning message will display. At this time, it is necessary to clean the filter screen according to instructions given in filter screen cleaning and replacement.

A filter screen is provided in the coolant tank. It is requested to pull out the coolant tank periodically for cleaning the coolant tank and the filter screen.

### **6.2.2. Cleaning and Replacing the Filter Can of Coolant through Spindle Device**

#### **Install Filter**

When installing the filter, it is necessary to leave proper space for moving the filter core and filter drum. Make sure the filter drum faces downward and the pressure difference indicator is visible clearly.

#### **Connect Pressure Difference Indicator**

The magnetic type pressure difference indicator is connected through 2-pole plug. According to DIN 43650 standard, the magnetic part can be reversed to change between normal open and normal close condition.

#### **Time for Replacing or Cleaning Filter Core**

When starting running, the indicator displays a warning signal. At this you should press the red button on the indicator. When the system runs for a period of time, if the indicator displays a signal, it means the filter core should be replaced or cleaned.

You are requested to frequently inspect the original MAHLE filter core to ensure the filtrating accuracy and quality. Throw-away type filter core (SMX) is not allowed for cleaning.

#### **Replace Filter Core**

1. When the system running stops, it is requested to release pressure from the filter.
2. Turn counter-clockwisely to remove filter drum for cleaning.
3. Remove the filter core, and check if plug and O ring in filter drum is damaged or not.
4. Install the filter core and check if the model number is the same.
5. Turn clockwisely for tightening the filter drum, then turn it 1/8 - 1/2 turn counter-clockwisely.

#### **Wash Filter Screen**

1. **Washing by ultrasonic (10 - 25  $\mu\text{m}$ )** Place the filter core in an ultrasonic washing tank for about 90 - 120 minutes (suggested for placing it vertically). Apply compressed air for blowing from inside to outside (cleanliness can reach 95%). (In case filtrating accuracy is over 40  $\mu\text{m}$ , washing time required is about 5 - 8 minutes).
2. **Manual washing (40 - 100  $\mu\text{m}$ )** Place the filter core in a clean tank. Apply detergent and brush for cleaning off the dusts. After cleaning, take it out, then place it in clean liquid about 20 minutes. Apply compressed air for blowing from inside to outside (cleanliness can reach 75%)

- When using above-mentioned washing methods, care should be taken to prevent the filter core from touching any sharp object. Failure to comply may affect the filtering quality.
- Mount the filter core. Turn clockwise for tightening the filter drum then turn it 1/8 - 1/2 turn counter-clockwise. Now the washing procedures are accomplished.

### **Cleaning Filter in Slideway Lubricator**

1. Loosen the oil filling cap (2) by turning it counter-clockwise.
2. Pull out the white cylindrical filtercore (3) by pulling it upward.
3. Apply high pressure air for blowing out dust or debris existed in the oil tank. If necessary, wash it by using kerosene.
4. After cleaning, fit the filter core to its position and lock the oil filling cap by turning it clockwise.



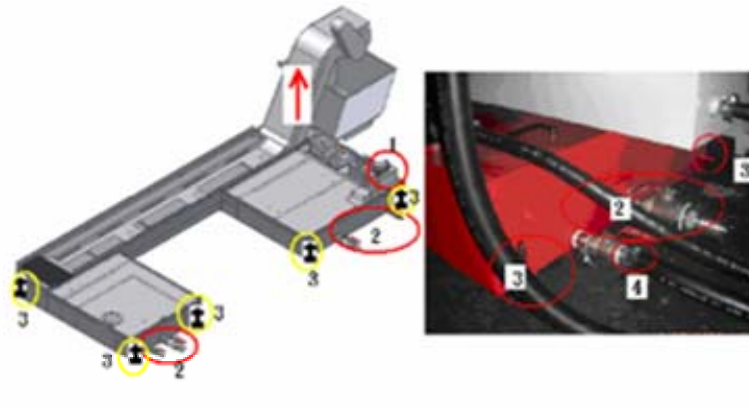
In case the slideway lubricator is dismantled for cleaning after it is assembled, you are requested to press the forced lubrication key (1) about 15 seconds. Also, the pressure should be over 9,8 bar to make sure the lubricator work normally.

### **Cleaning Coolant Tank**

1. Disconnect the power plug (1) the coolant motor.
2. Close all ball valves (2) located at outside surface of the coolant tank.
3. Remove all coolant hoses that connect the machine to the coolant tank. (Loosen hose clamp (4) before removing hose)



4. Use ball valve switch (1) to suck coolant to an external container.
5. Loosen all adjustment and fix screws, so that the coolant tank can move freely (3).



6. Pull the coolant tank forward.
7. When the machine is equipped with a chip conveyor, you also need to remove the lock screws, then separate the chip conveyor from the coolant tank.
8. Open the coolant tank cover for cleaning interior.
9. Reverse above procedure for mounting the coolant tank.

### Adjusting Air Pressure and Lubrication on Filter/Regulator/Lubricator Combination Unit

1. Pull the regulation knob (1) upward.
2. Turn the regulation knob clockwise or counter-clockwise, so that the pressure indicated on the pressure gauge (2) is in the range of 5.9 – 6.9 bar.



3. The part (3) is an automatic water drain valve. When air pressure is under 3.9 bar, it will automatically drain eater and exhaust air.
4. The part (4) is an oil cup. When filling oil is required, push the oil cup upward or remove the oil filling screw (5). However, it is requested to stop air or fisconnect air source before making above motion. The red oil window means the oil level. When the oil window completely displays green color it means you need to fill oil.
5. The part (6) is an oil flow regulation knob for the entire air system. The normal condition is oil drop once after 5 - 6 times of tool change.

### **Adjusting Pressure on Z - Axis Counter-Balance**



1. Adjust pressure to approximate 2.9 bar by turning the pressure regulation knob.
2. Move Z-axis upward/ downward, at this time check the Z-axis current displayed on the screen. Slowly increase pressure until loading on Z+ and Z=motions are equal. (Normal pressure is in the range of 3.7 – 4.4 bar)
3. In case pressure is improperly set (too high pressure), you should open the air exhaust valve shown figure below. Reduce balancing pressure about 2.9 bar. Close the air exhaust valve and repeat procedures (1) and (2).



### Various Cautions

- Before operating the machine, carefully read the maintenance manual and operation manual.
- Do not alter the machine structure, travel and parameters. Also do not replace parts not supplied from the NCT. Ltd.
- The grounding wires, power source, foundation and air source etc. in the customer's factory must fully meet the machine's requirements.
- Do not keep the spindle running at high speed for a long time. After 8 hours of continuous running, stop it for one hour.
- The big workpiece should be fixed directly on the table. Mark sure the flatness of the workpiece bottom. Always avoids deformation on table surface as this may result in overload on X-axis motor.
- Do not use low burning point and flammable cutting fluid to avoid fire.
- During machining, do not open the safety door. Failure to comply may result in personal danger.
- Do not use poor quality of oil coming from unknown brand, because it may cause damage on the machine.

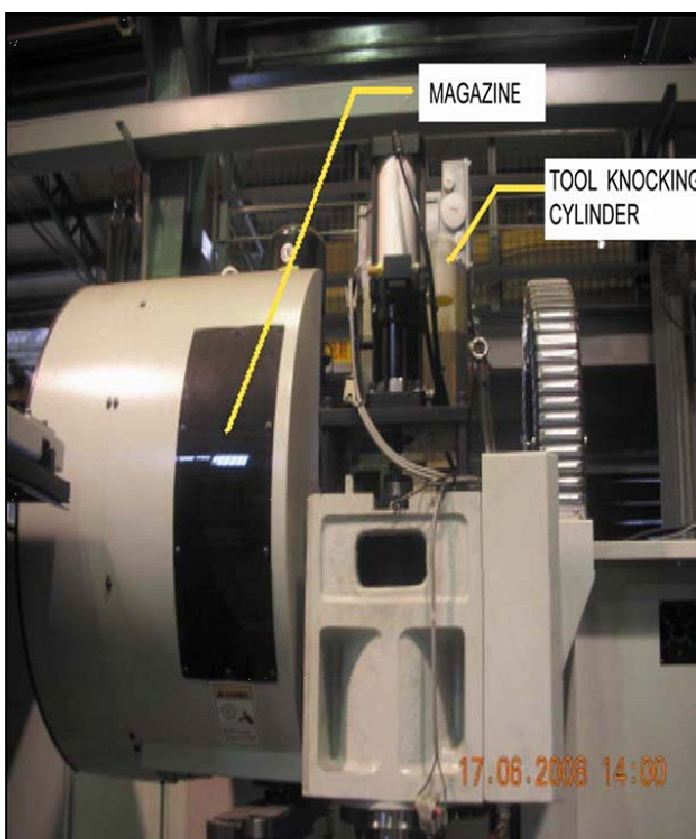
### **Periodic Inspection**

- Clean spindle hole and tool change arm (check everyday).
- Check if air pressure is normal or not (check everyday).
- Check if cooling fan is normal or not (check everyday).
- Check if coolant amount in the coolant tank is sufficient or not (check everyday).
- Check if filter of filter/regulator/lubricator combination unit is clean enough or not (check every week).
- Check if filter screen for spindle oil cooler is clean enough or not (check every week).
- Clean off chips existed in the chip channel in the coolant tank (check every week).
- Inspect backlash and the machine leveling (check every 3 months).
- Inspect the machine positioning accuracy (check every 6 months).

## 7. LUBRICATION AND SUGGESTED OIL

### 7.1. Fill Lubrication Oil, Cooling Oil And Hydraulic Oil

MECHANISMS	SUGGESTED OIL
Lubrication oil tank	R68 Slideway oil
Cooler oil tank	R10 or R32 ingot oil or hydraulic circulation oil
Cam of ATC	ISO VG150 (or 220) gear oil
Hydraulic oil tank (optional)	R32 hydraulic circulation oil
Filter/regulator/lubricator unit	R32 hydraulic circulation oil
Air cylinder for spindle tool unclamping	R32 hydraulic circulation oil





## 7.2. Suggested Oil and Filling Frequency

Mechanisms, Items	Suggested Oil		Change Frequency
	Mobil	Shell	
Linear ways and ball screws	Vactra OIL No.2	TONNA OIL T68	Fill everyday
Filter/regulator/lubricator	HYDRAULIC OIL AW32	HYDRAULIC OIL 32	Fill weekly
Hyd. power unit	HYDRAULIC OIL AW32	HYDRAULIC OIL 32	Fill weekly
Spindle oil cooler	HYDRAULIC OIL AW32	HYDRAULIC OIL 32	Fill weekly
4th axis gears	Mobilgear 629	OMALA 150	Fill weekly
Cam box of magazine	Mobilgear 629	OMALA 150	Fill weekly
Chip conveyor	SHELL Alvania(LF) 00 grade		Fill every 3 months

Lubrication oil for linear ways, ball screws and filter/regulator/lubricator unit are consumable, therefore you need to fill oil periodically. Lubrication oil for other mechanisms are enclosed and circulated, under normal condition the oil is hardly reduced. Normally oil for such mechanisms needs to be replaced in one year, however periodically check and fill oil are still requested. In case oil is seriously reduced with unknown reason, contact the NCT Ltd.

Do not use unknown brand of oil or any oil not approved by the NCT Ltd.

## 7.3. Suggested Oil and Amount

### Slideway Oil

Suggested Oil		Capacity	
MOBIL	VACTRA OIL NO.2	VMC-1600P	6 liters
SHELL	TONNA OIL T68	VMC-1200	4 liters
ESSO	FEBIS K68	VMC-1400	4 liters
BP	MACCURIAT D68	VMC-1100	4 liters
ELF	MOGLIA 68	VMC-1200S	4 liters
C.P.C.	C.P.C. Slideway Oil		

### Oil for Spindle Oil Cooler (without ZF Gearbox) and Filter/Regulator/Lubricator Unit

Suggested Oil		Capacity	
MOBIL	D.T.E LIGHT	Spindle oil cooler	20 liters
SHELL	TURBO T32	F.R.L. unit	100 CC
ESSO	TERESSO 32		
BP	ENERGOL THB32		
ELF	MISOLA H32		
C.P.C.	High class ingot oil m22		

### Oil for 4th Axis Hydraulic Oil Tank and Tool Knocking Cylinder

Suggested Oil		Capacity	
MOBIL	HYDRAULIC OIL 32	4th axis hyd. oil tank	30 liters
SHELL	SHELLTELLUS OIL 32	Tool knocking cylinder	100 CC
ESSO	TERESSO 32		
C.P.C.	Special circulation oil R32		

### Oil for Magazine Gerars and 4th Axis Gears

Suggested Oil		Capacity	
MOBIL	MOBILGEAR 629	Magazine gears	10 liters
SHELL	OMALA EP150	4th axis gears	5 liters
ESSO	SPARTANE EP150		
C.P.C.	Multi-function gear oil 85w/140		

If the machine is equipped with a ZF gearbox, the ZF gearbox and spindle oil cooler should use #32 special circulation oil. In this case, the oil tank is located at side of the spindle head. The spindle oil cooler does not have an oil tank.

Suggested Oil		Capacity	
MOBIL	DTE OIL LIGHT	Auxiliary oil tank	10 liters
SHELL	SHELL TELLUS OIL 32		
ESSO	TERESSO 32		
C.P.C.	Special circulation oil		

Above mentioned "suggested oil" and "capacity" are for reference only. For correct information refer to the supplied manual.

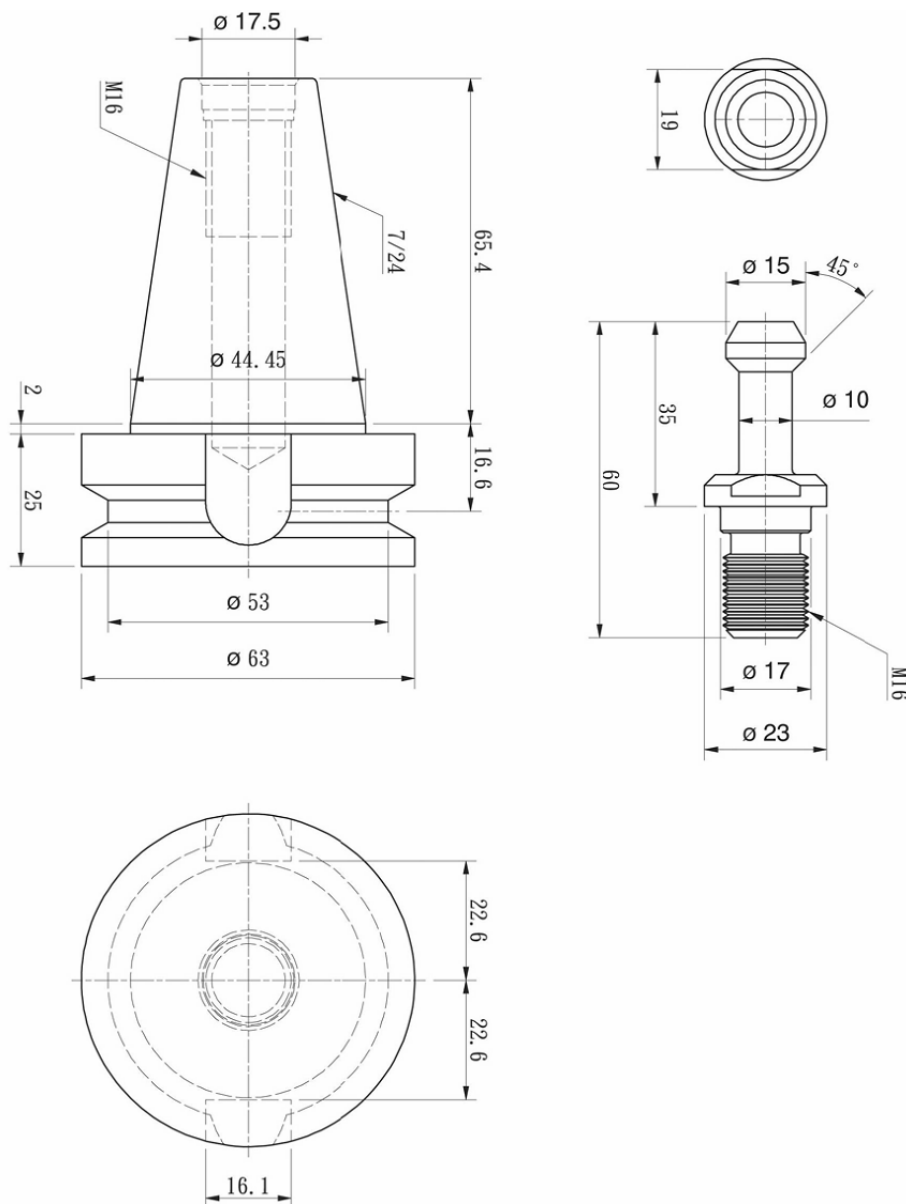


## 8. AUTOMATIC TOOL CHANGER

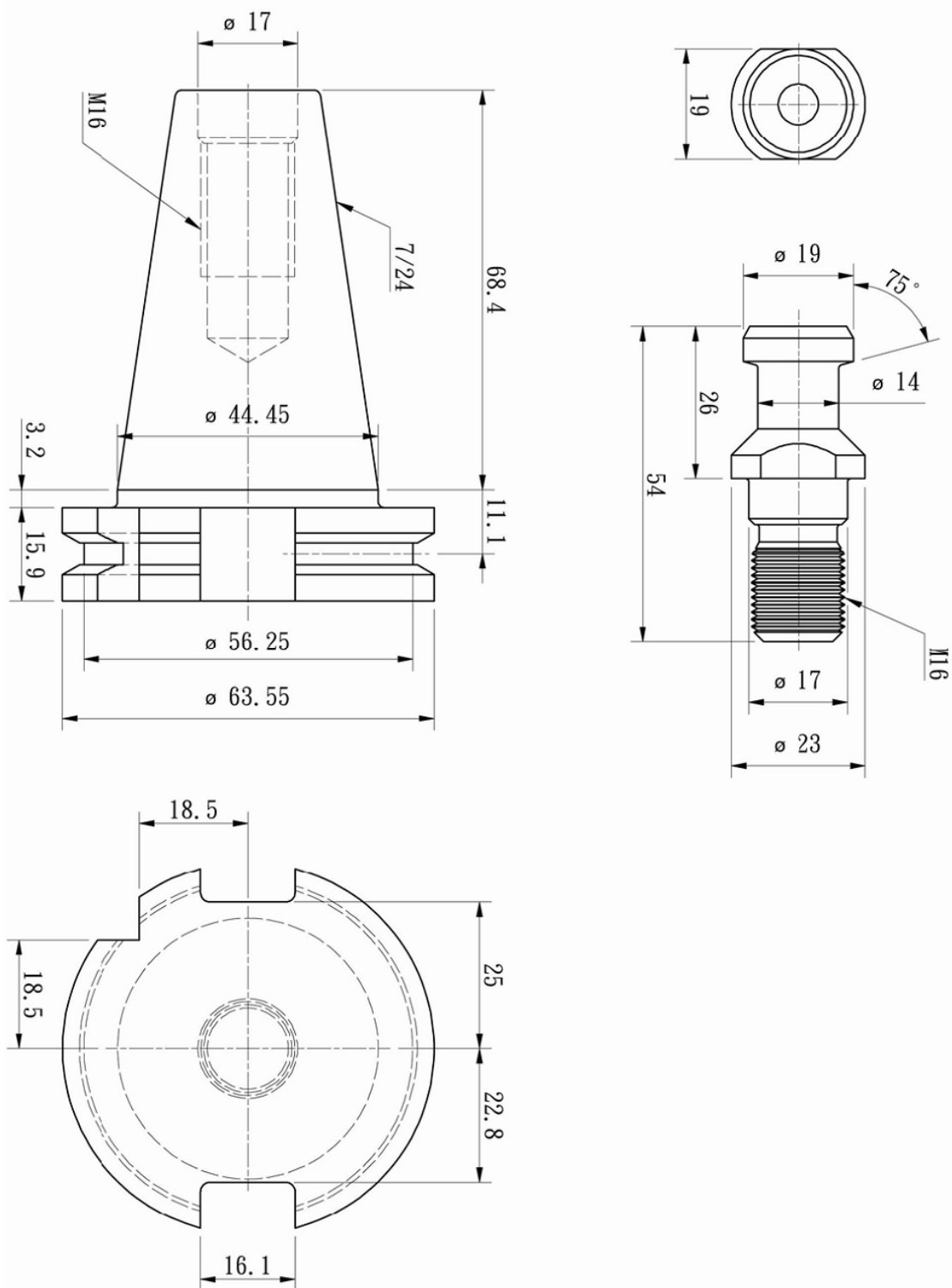
The machine accommodates various types of tools, such as #40, #50, BT, DIN or CAT etc. Specify your desired tool types when ordering. Various tool types are shown as following:

### 8.1. Tool Shank and Pull Stud

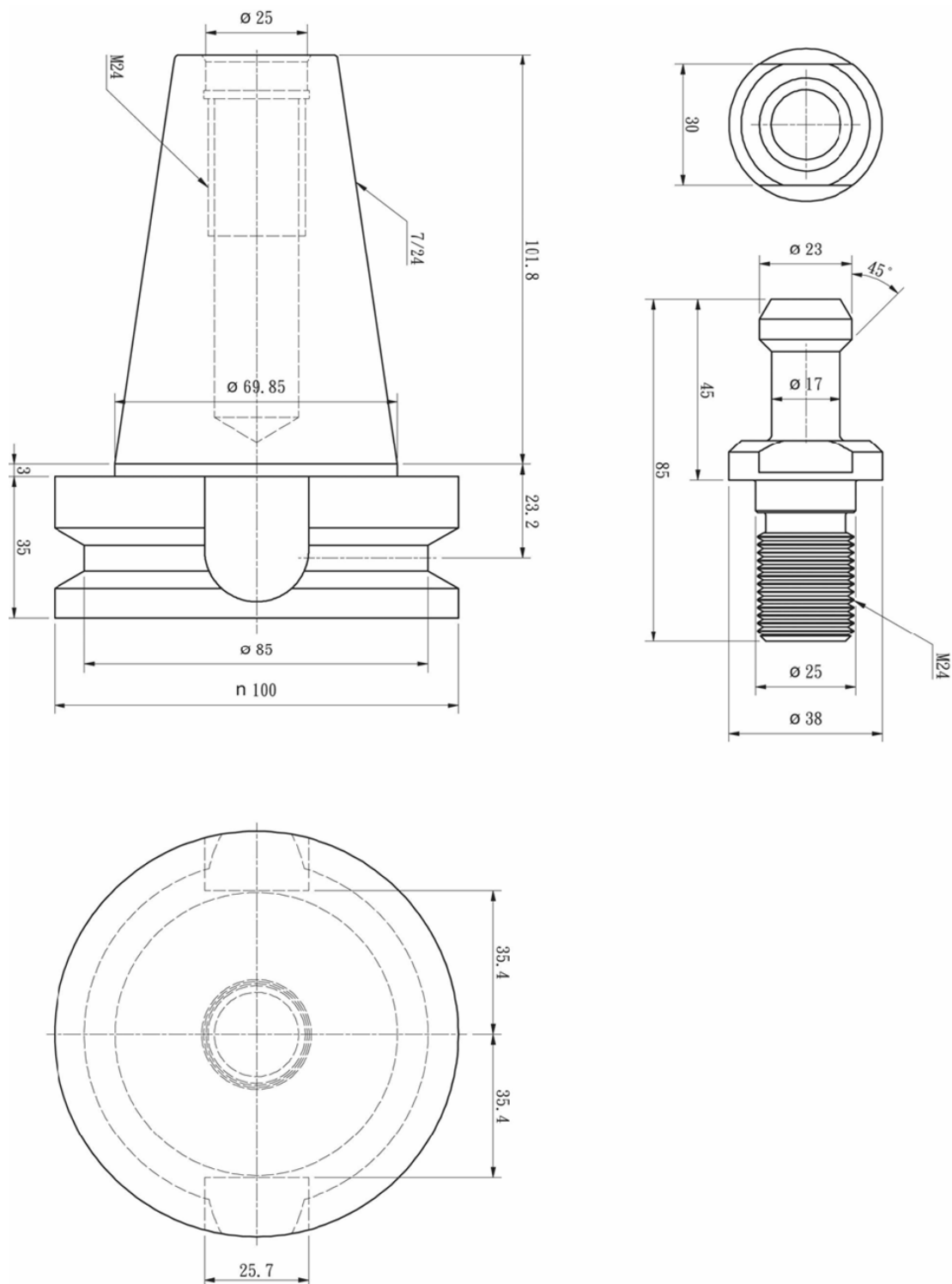
#### BT40 Tool Shank and Pull Stud



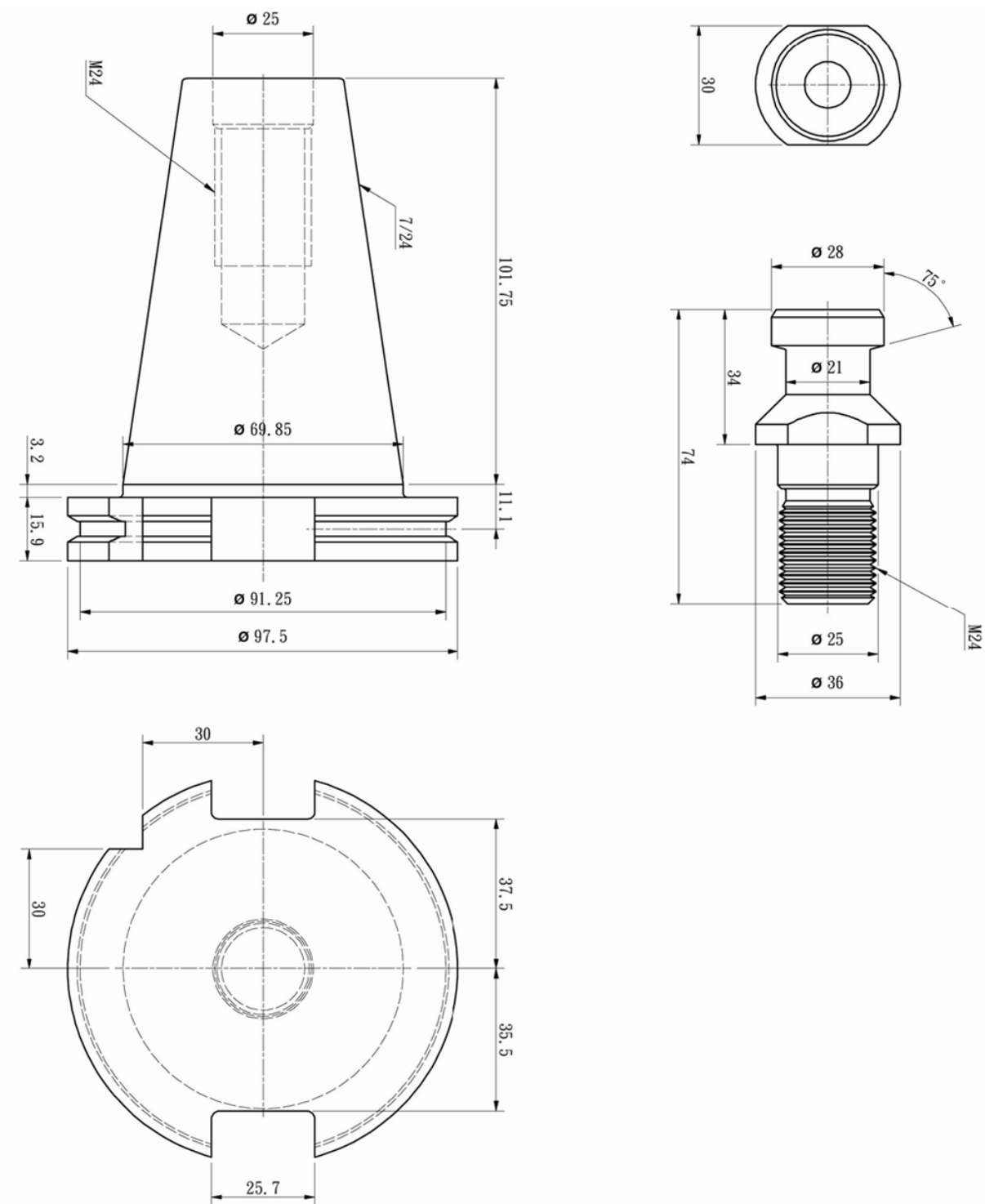
### DIN40 Tool Shank and Pull Stud



### BT50 Tool Shank and Pull Stud



### DIN50 Tool Shank and Pull Stud



## 8.2. Maximum Tool Sizes

Specif.	Max. tool dia. (adjacent tool)	Max. tool dia. (adjacent empty tool)	Max. tool length
BT40	80	125	300
DIN40	80	125	300
CAT40	80	125	300
BT50	100	150	300
DIN50	100	150	300
CAT50	100	150	300

- **ADJACENT Tool:** When adjacent tool pocket is loaded with tool, the tool pocket can not be loaded with special or big diameter of tool.
- **ADJACENT EMPTY Tool:** When big diameter of tool or special tool shall be loaded on the tool pocket, then its adjacent tool pockets at right and left side can not be loaded with tools.

## 8.3. Automatic Tool Change

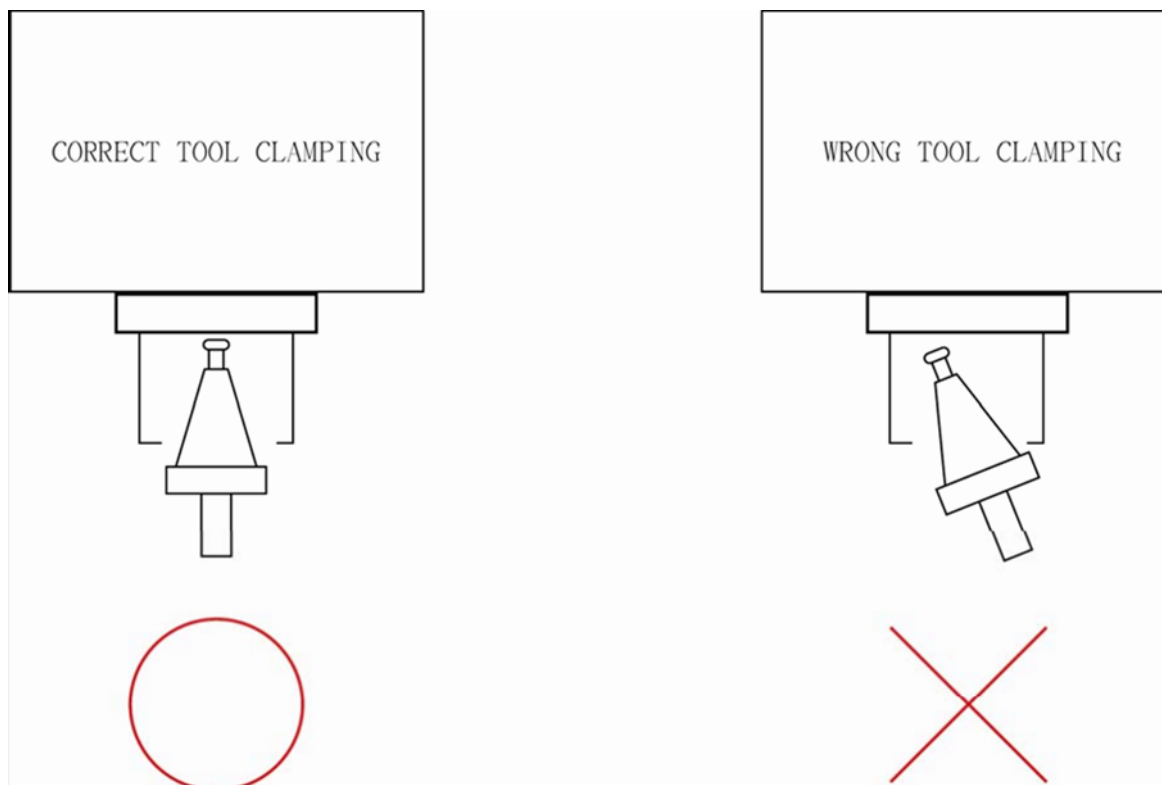
The automatic tool changer is a standard equipment. Normally the tool change is operated at the side of spindle. Loading and unloading cutter on the magazine is performed only when performing maintenance, which requires special tool. Loading and unloading cutter according to following procedures:

1. Execute tool change command for calling the tool number to be loaded for example T01 M06, then the No.1 tool will be moved to the side of spindle.
2. Open the safety door, and fit the tool into the spindle (Press the tool clamping/unclamping button located at front side of spindle head).
3. Close the safety door.
4. Repeat procedures (1)□(3) for loading tool on the magazine.

Tool unloading procedures are same as above, except at step 2 the tool fitting is changed to tool releasing.

#### 8.4. How To Correctly Fit Tool

The tool clamping and unclamping is made from the side of spindle. Tool unclamping from the magazine is applied only when performing maintenance.



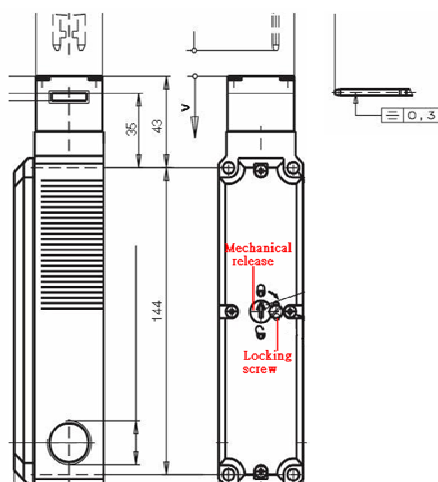
Care should be taken for direction when fitting DIN and HSK tool shank.

## 9. ESCAPING PROCEDURES WHEN PERSONNEL CORNERED IN THE MACHINE

### 9.1. Safety Door with Interlock Device

It is not allowed to enter the working area of the machine to carry out cleaning or for other reasons. Anyway in case the personnel is trapped inside, he has to go out through the front door or side doors.

The front door is equipped with an interlock device. When the door is closed and power is turned off, the safety door will lock automatically. In this case, the personnel should use the special key, provided at near the safety switch, for releasing the interlock device. Then open the front door for leaving the machine.



#### Mechanical Release

In the event of malfunctions, the guard locking can be released with the mechanical release irrespective of the state of the solenoid (see Figure).

- Unscrew locking screw.
- Using a screwdriver, turn the mechanical release by around 180° in the direction of the arrow.

The mechanical release or the mechanical key release must be returned to its original position and sealed after use (for example with sealing lacquer or using wire). Please observe the supplied dimension drawing in the case of mechanical key release.

### 9.2. Safety Door without Interlock Device

If operator or maintenance personnel is cornered in the machine, he can easily leave the machine from the front door or both-side doors because the safety door is not equipped with interlock device. (option)

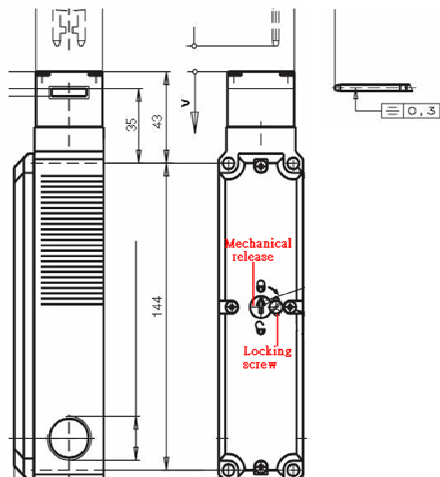
### 9.3. Front Door Has Interlock Function, but Side Doors Do Not Have

It is not allowed to enter the working area of the machine to carry out cleaning or for other reasons. Anyway in case the personnel is trapped inside, he has to go out through the front door or side doors.

If operator or maintenance personnel is cornered in the machine, he can easily leave the machine from both-side doors. If the personnel needs to leave the machine from the front



door, he should use the special key, provided at near the safety switch, for releasing the interlock device, then he can open the front door for leaving.



### Mechanical Release

In the event of malfunctions, the guard locking can be released with the mechanical release irrespective of the state of the solenoid (see Figure).

- Unscrew locking screw.
- Using a screwdriver, turn the mechanical release by around 180° in the direction of the arrow.

The mechanical release or the mechanical key release must be returned to its original position and sealed after use (for example with sealing lacquer or using wire). Please observe the supplied dimension drawing in the case of mechanical key release.

## 10. MACHINE TROUBLES AND CAUSES

*The machine trouble is caused by human factors or natural disasters.*

### Human Factors

1. Abnormal operations, such as incorrect program, incorrect tool compensation, incorrect setting of workpiece home position, incorrect cutting condition, too heavy workpiece or workpiece weight exceeds rated table loading capacity etc. Above factors may result in machine damage or colliding.
2. Machine damage is caused by maintenance personnel or manager does not thoroughly conduct maintenance instruction, operator is not well trained or incorrect use of oil.
3. Machine service life will be influenced by following factors, such as improper design, incorrect use of parts or improper assembly etc.

### Natural Disasters

Thunder strike, flood and fire may cause electronic parts burn-out or machine parts damage, which are unavoidable factors. The user should make proper protection to reduce damage to a minimum.

#### 10.1. Brief Instructions of Troubles

TROUBLES	PROBALE CAUSES
Electronic parts damaged	<ol style="list-style-type: none"> <li>1. Lack of phase or incorrect voltage input.</li> <li>2. Excessive current.</li> <li>3. Short circuit caused by too much moisture.</li> </ol>
Abnormal spindle noise or high temperature	<ol style="list-style-type: none"> <li>1. Bearing damage caused by colliding or overload cutting.</li> <li>2. Oil cooler is abnormal.</li> </ol>
Spindle orientation failed	<ol style="list-style-type: none"> <li>1. Orientating sensor is damaged, wire is broken or position is improperly adjusted.</li> <li>2. Spindle belt is broken.</li> </ol>
Serious vibration of spindle	<ol style="list-style-type: none"> <li>1. Bearing damage caused by colliding.</li> <li>2. Improper dynamic balance of spindle.</li> <li>3. Poor dynamic balance of tool</li> <li>4. Spindle motor is damaged.</li> </ol>

TROUBLES	PROBALE CAUSES
Tool can't be released from spindle	<ol style="list-style-type: none"> <li>1. Air solenoid valve or tool unclamping cylinder is damaged.</li> <li>2. Insufficient unclamping amount.</li> <li>3. Spindle part is damaged such as breakage of disc spring.</li> <li>4. Incorrect specifications of tool or pull stud.</li> </ol>
Automatic tool change failed	<ol style="list-style-type: none"> <li>1. Spindle can't orientate.</li> <li>2. Tool unclamping failed.</li> <li>3. Tool pocket can't swing tool</li> <li>4. Magazine or tool change arm can't rotate.</li> </ol>
Malfunction of magazine	<ol style="list-style-type: none"> <li>1. Counting proximity sensor for magazine is abnormal.</li> <li>2. Abnormal tool change.</li> </ol>
Traveling overload	<ol style="list-style-type: none"> <li>1. Poor lubrication on slideways due to lack of oil.</li> <li>2. Too heavy workpiece.</li> <li>3. Bearing or ball screw is jammed.</li> </ol>
Traveling noise	<ol style="list-style-type: none"> <li>1. Bearing or ball screw is jammed.</li> <li>2. Telescopic guard is damaged.</li> <li>3. Motor or driver is damaged.</li> </ol>
Lack of oil on slideways	<ol style="list-style-type: none"> <li>1. Oil hose is broken or jammed.</li> <li>2. Sideway lubricator is damaged.</li> <li>3. Oil distributor is damaged.</li> </ol>
Insufficient oil pressure on slideways	<ol style="list-style-type: none"> <li>1. Oil hose is broken or damaged.</li> <li>2. Slideway lubricator is damaged or filter screen is jammed.</li> <li>3. Incorrect slideway oil.</li> </ol>
Cutting fluid delivery failed	<ol style="list-style-type: none"> <li>1. Cutting fluid motor is damaged.</li> <li>2. Coolant tank or fluid hose is jammed.</li> <li>3. Solenoid valve is damaged.</li> </ol>
Chip auger (chip conveyor) overload	<ol style="list-style-type: none"> <li>1. Motor is damaged.</li> <li>2. Chip auger (chip conveyor) is jammed.</li> </ol>

TROUBLES	PROBALE CAUSES
Cool through spindle failed	<ol style="list-style-type: none"> <li>1. Coolant motor is damaged.</li> <li>2. Filter screen or coolant hose is jammed.</li> </ol>
Working light does not light on	<ol style="list-style-type: none"> <li>1. Light tuber or bulb burn out.</li> <li>2. Fuse burn out</li> </ol>
Spindle oil cooler damaged	Refer to the oil cooler operation manual.
Automatic air blow failed	<ol style="list-style-type: none"> <li>1. No air supply.</li> <li>2. Solenoid valve is damaged.</li> <li>3. Air hose is jammed.</li> </ol>
Spindle belt breakage	<ol style="list-style-type: none"> <li>1. Colliding or cutting overload.</li> <li>2. Poor belt quality or incorrect specifications.</li> </ol>

## 10.2. Simple Trouble Shooting

- Trouble causes and error codes will be displayed on the screen. The maintenance personnel may try to find the probable causes and correction instructions in the operation manual according to the displayed alarm message and error code. If trouble shooting has been conducted according to instructions given in the operation manual, but trouble still exist. At this time, contact the machine manufacturer or your local agent for repair assistance. Do not alter parameters or dismantle the machine without authorized to do so.
- Some troubles can not be identified by error message displayed on the screen, however they can be checked by other methods. These troubles such as mechanical parts are not detected by the control, but can be judged by noise, temperature and accuracy. Such troubles are repaired only by the machine manufacturer(agent) or well-trained maintenance technician.
- SPINDLE OIL COOLER OR HEAT EXCHANGER DAMAGED – Try to find cause and correction method for the trouble according to the error message displayed on the control panel of the device. To perform trouble shooting, it is requested to refer to the operation manual of the device.
- CONTROL DAMAGED – In case the control system is damaged, do not dismantle or repair it by yourself. Contact the NCT Ltd. for repair.

Be sure to stop the machine and turn power off before performing any maintenance job. If you need to climb to a high position, care should be taken for personal safety and avoid the danger of falling or slipping.

## **11. CAUSES AND ANALYSIS FOR DANGER OCCURENCE**

### **11.1. Machine Noise**

#### **Spindle Noise**

The major noise is created by high speed running of the spindle. As the spindle rotation is driven by a motor through belts transmission, a considerable noise may create due to friction between belts and pulley. Such noise is greatly reduced (under 80 dB) by the spindle head guard and the enclosed splash guard. If these guards are removed, noise may reach up to 85dB. Therefore except performing maintenance by experienced personnel, under any circumstance do not remove these guards.

#### **Cutting Noise**

Metal cutting normally create high noise, which is hard to reduce. When cutter is removing metal material, the friction and impact sound will create between the cutter and the workpiece, such noise can be reduced only by changing cutting data or cutting method.

#### **Other Noises**

A slight noise also may create through motor, fan, hydraulic power unit, automatic tool changer, air blast device and chip conveyor etc.

- The values here indicated are emission's levels and they are not necessarily considered safe working levels. Although there is relationship between the emission's levels and the exposition, this can not be used in a reliable way in order to establish if they requirements or precautions. The factors which influence the actual exposition level of the operators include the environment conditions, the other noise sources, that is the number of machines and of other adjacent working processes. Even the level of exposition can vary from one country to another. But these information allow the operator to do a better evaluation of the danger and of the risk.

#### **Machine Sound Level / Noise Emission (VMC-1100) (SUMO-1100)**

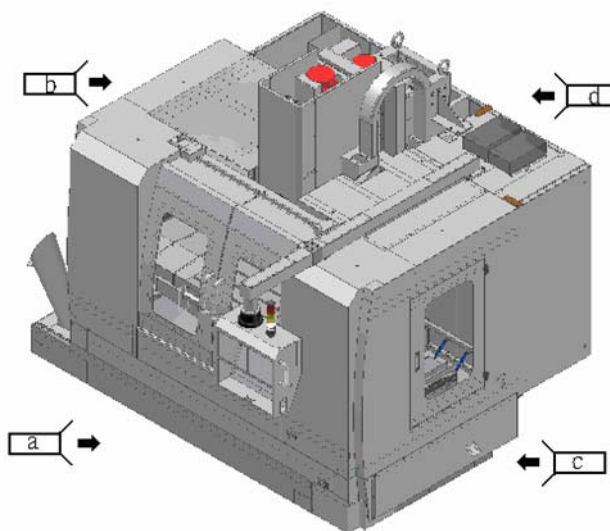
The sound level of machine with standard specification is below 80db. Values of aerial noise produced by the machine, according to section 1.7.4 (f) of ANNEX 1 of 98/37 EC DIRECTIVE:

Measure position	Unit	a	b	c	d
Value of the continuous acoustic pressure level if over 70 dB(A). (It should be mentioned if below 70 dB(A).	dB(A)	73	71	73	71
Maximum value of instantaneous acoustic pressure dB(C).	dB(C)	<130	<130	<130	<130
Value of level of emitted acoustic power, if the continuous acoustic pressure level is over 85 dB(A).	dB(A)				

### Data collecting system

The measuring position is as shown on drawing and is taken at 1600 mm from the floor and at 1000 mm from the machine.

Measuring conditions: \*Spindle rotation at maximum speed. (8,000 rpm / 10,000 rpm / 12,000 rpm) (not cutting)



## 11.2. HIGH TEMPERATURE

### Motor

When 3 axes move at high speed for a long time, the 3-axes motors will create high temperature. Before shipment, some protection measures have been made to avoid high temperature on motors, such as over-temperature protection, overload protection and over-current protection.

### **Spindle**

The spindle heat generation results from high speed running for a long time. Especially the motor shaft has higher temperature. With the spindle oil cooler to reduce the spindle temperature, there is no risk of burning danger. High temperature occurs only when the spindle searing is damaged. When this occurs, a warning message will display and serious noise occurs. At this time the operator must stop the machine immediately. Turn power off and ask experienced technician for repair. Do not try to Pick tool or touch the spindle and to avoid the danger of burning.

### **ZF Gearbox**

The ZF gearbox is available only for machine with automatic spindle speed change. The gearbox is mounted under the spindle motor, featuring forced oil cooling function. The normal working temperature is about 60°C. The ZF gearbox is protected by the spindle head guard, so that the operator can not touch it.

### **Hydraulic Power Unit**

The hydraulic power unit is available only for machine with hydraulically operated 4th axis or special tool changer. It is equipped with heat-dissipation fan for cooling. However its boosted pump may generate high temperature, do not try to touch it.

### **Cutting Tool**

Once cutting job is just finished, the cutting tool is still in high-temperature condition especially when performing dry cutting. It is suggested to apply automatic tool change function or wear safety gloves when changing tool is required.

## **11.3. Impact**

Impact danger may result from incorrect clamping of cutting tool or workpiece, malfunction of automatic tool changer, excessive workpiece sizes (workpiece area is bigger than table) or incorrect operation etc. Always remember do not open the safety door during machining. The operator is not allowed to enter into the machine.



#### **11.4. Sharp Corner**

The cutting tool and workpiece have sharp corners. Care should be taken when taking and moving them. Proper personal protection may reduce damage to a minimum.

#### **11.5. Slipping**

##### **Slipping in the Machine**

The table is precision ground. Standing on the table may cause the danger of slipping.

##### **Slipping at Working Area**

Always keep the working area clean. In case cutting fluid or lubrication oil leak, clean it immediately to prevent operator or any personnel from slipping.

## **12. HOW TO AVOID IMPROPER MAINTENANCE OF THE MACHINE**

- In case alarm message occurs, read the operation manual before performing maintenance. Make trouble shooting according to alarm number. Do not adjust or alter parameters as desired.
- Under any circumstance, if you need to enter into the machine, be sure to press the emergency stop switch before entering to avoid accident.
- Keep the original operation manual and spared disc. Each machine has its unique serial number. Do not apply spared information for adjusting system or parameters even for a similar machine.
- Use only appropriate tools for machine maintenance.
- Use only the replacement parts supplied or approved by the original manufacturer. Do not use replacement parts from unknown brand.
- Do not alter the setting values of parameter in the control.
- In case machine trouble occurs, stop the machine immediately then contact the NCT Ltd. Do not make trouble shooting until you inquire with the NCT Ltd.
- When inspecting electronic parts or control circuit is required, be sure to turn power off before opening the electric cabinet door or the control box guard. Failure to comply may cause the danger of electric shock.